ELECTRICAL WEST

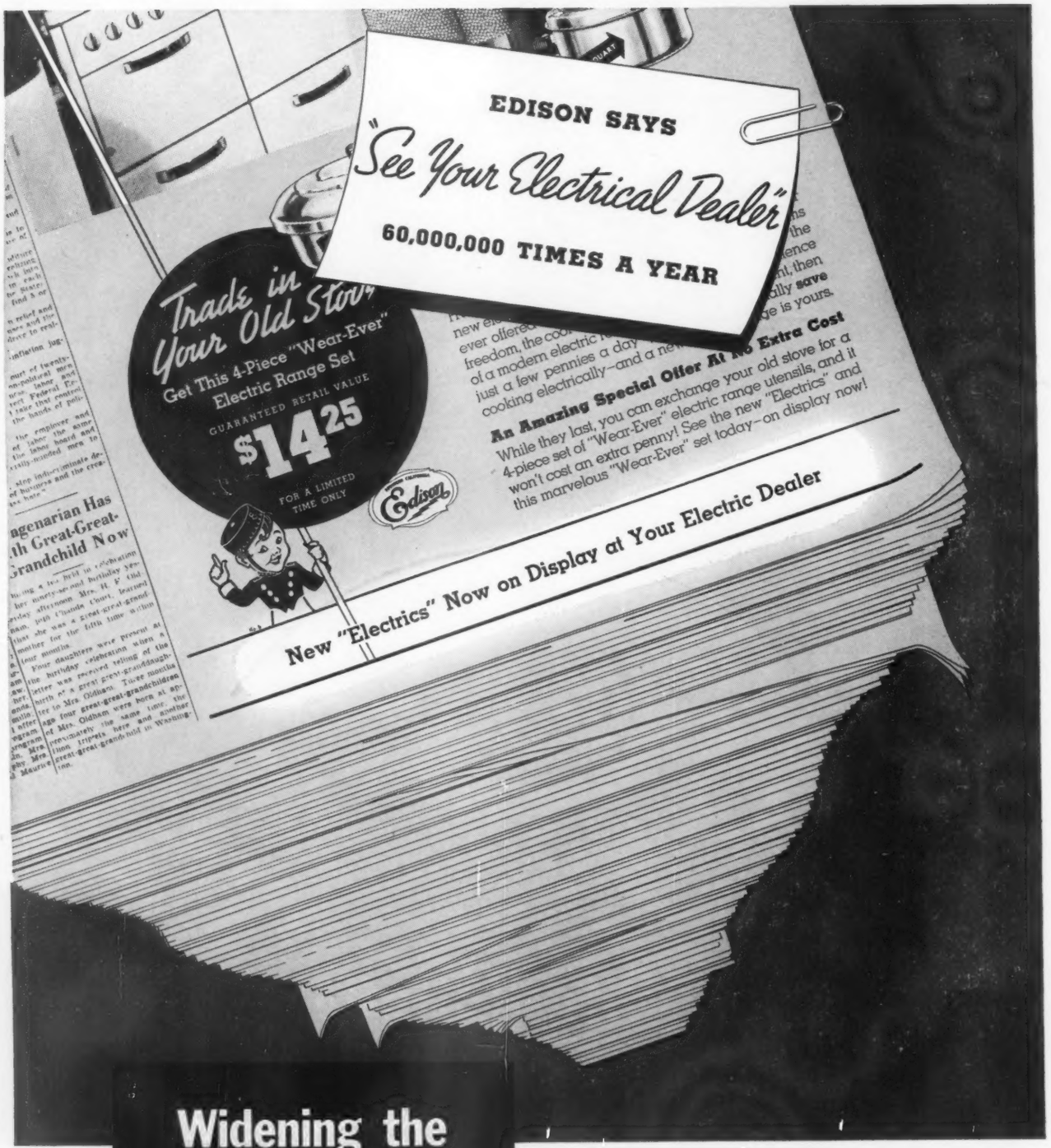
THE ALL-INDUSTRY MAGAZINE OF PROGRESS

Sixth Annual Convention-in-Print

★

JUNE
1938

McGraw-Hill Company
of Calif.
Price 50c Per Copy


EDISON SAYS
"See Your Electrical Dealer"
60,000,000 TIMES A YEAR
Trade in Your Old Stove
Get This 4-Piece "Wear-Ever" Electric Range Set
GUARANTEED RETAIL VALUE
$14.25
FOR A LIMITED TIME ONLY
Edison
An Amazing Special Offer At No Extra Cost
While they last, you can exchange your old stove for a 4-piece set of "Wear-Ever" electric range utensils, and it won't cost an extra penny! See the new "Electrics" and this marvelous "Wear-Ever" set today—on display now!
New "Electrics" Now on Display at Your Electric Dealer

Widening the Appliance Market

In more than 250 newspapers and periodicals, in house organs, display signs and direct mail literature, Edison repeats the phrase, "See Your Electrical Dealer" an estimated sixty million times a year. This service is rendered freely because we know that increased electrical load can come only from increased appliance sales. Progressive manufacturers and dealers are aware of this opportunity and run their own tie-in advertising to cash in on this tremendous weight of advertising and publicity. 6-38

SOUTHERN CALIFORNIA EDISON COMPANY LTD.

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The All-Industry Magazine of Progress

ELECTRICAL WEST

MEMBER AUDIT BUREAU OF CIRCULATIONS

ESTABLISHED 1887 AND INCORPORATING THE "ELECTRICAL JOURNAL," "JOURNAL OF ELECTRICITY, POWER & GAS" AND "JOURNAL OF ELECTRICITY"

McGRAW-HILL COMPANY OF CALIFORNIA
883 Mission Street, San Francisco

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WELCOME

By BERKELEY SNOW
Ex-Northwest Editor

WHEN I was invited to be guest conductor of this column this year I was told there was to be no levity. "Life is real; life is earnest," they said. "This year, anyway."

Don't believe them. Not for a long time have we seen so much unreality and lack of earnestness in the lives of those in high places. Never has there been such a premium on imagination.

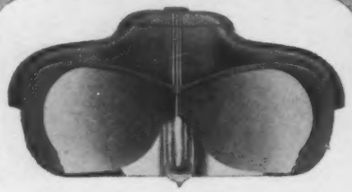
That is why a Convention-in-Print—to stimulate the imagination.

Use it now. . . . You have left the special train which brought you and the others, sitting up half the night in the club car, to convention city. You are settled in your room at headquarters hotel. You have met a number of your old cronies at breakfast. You have registered. You are in a mood to be informed, stimulated, inspired.

Enter, then, the door of the first general session; take your seat. The chairman is calling the meeting to order. Turn the page and start with the presidential addresses. Follow the convention from there — right through to the last report. . . . There will be ideas and suggestions you can turn to your use. Ideas and suggestions which will further your personal success as much as they will further the success of this Western electrical industry of ours — the world's greatest electrical field.

CALIFORNIA MATCHES VISIBILITY AGAINST SPEED *On Bayshore Highway!*

Westinghouse Highway Luminaires on a section of the Bayshore Highway. Even under the most adverse conditions (when pavement is wet as shown in the photograph), adequate visibility for drivers is provided.



Fifty-five Westinghouse Highway Luminaires (burning 10,000-lumen sodium-vapor lamps in a vertical position) are installed on one section of the Highway.

Thirty-five Westinghouse Reflectolux Sr. Luminaires (enclosed units burning 10,000-lumen sodium lamps) are installed on another section of the highway.

WESTINGHOUSE SODIUM LUMINAIRES INSTALLED TO REDUCE NIGHT DEATHS

Eighty-two per cent of all traffic deaths on the San Francisco Bayshore Highway occurred at night when only 25% of the traffic was on the highway.

After many safety efforts had proved ineffective, the Division of Highways of the State of California installed modernly designed sodium-vapor highway luminaires in the hope of matching visibility for the automobile driver against speed and other hazards of the heavily traveled highway.

More than a hundred luminaires are now mounted along the most hazardous stretch of this highway . . . where the accident rate has been highest and where heavy fogs are frequent. The sodium lighting units flood the roadway with a mellow golden-yellow light which allows automobile drivers to see approaching dangers or unusual road hazards far enough ahead to avoid them in either dry or wet weather.

The Westinghouse Sodium Highway Luminaire, one of the three types installed on the Bayshore Highway, is constructed for either 6,000- or 10,000-lumen sodium-vapor lamps mounted vertically. This unit is designed to direct a large portion of the monochromatic sodium light on the road surface.

For complete details on the Sodium-Vapor Luminaire and the Westinghouse Reflectolux line of street and highway lighting units, call your local Westinghouse Lighting Specialist or address Westinghouse Electric & Manufacturing Company, Lighting Division, Edgewater Park, Cleveland, Ohio.

WHEN YOU THINK OF *Lighting Equipment* THINK OF

Westinghouse

Please!

.. and you get it with O-B CLAMPTOPS and SILENTYPES

"HUSH TWINS," you might call them, the Silentype and Clamptop. For both are free from annoying radio interference—both offer quietness at an ample margin above rated operating voltages. The popular Silentype, designed expressly to end insulator radio troubles, costs just a few cents more than a conventional pintype. The new Clamptop, priced a little above the Silentype, employs a clamp instead of the usual tie wires to hold the conductor and therefore banishes all of the evils of tie wire practice along with radio disturbance. If you're having radio troubles from insulators, install either Silentypes or Clamptops. In solving your problem, they'll replace costly complaints with valuable good will.

The CLAMPTOP

Stops conductor wear from tie wire rubbing, provides permanent connection between conductor and insulator, makes hot-line changes easier and safer, permits vertical conductor movement, and enhances appearance of lines, in addition to eliminating radio interference.

The SILENTYPE

2012-H

OHIO BRASS

MANSFIELD, OHIO

Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont., Canada

DUALBREAK *means* the distributing of the circuit breaking arc to two separate points in each leg. Two breaks means greatly reduced arc . . . and greater safety.

Did You Say Two Breaks?
that's what we said—
Two Breaks!

COLT-NOARK DUALBREAK SWITCHES

break the circuit in two places—to cut down arcing

How much *safety* is there in a *safety switch?* That depends entirely on the design . . . and the thoroughness of construction. Colt-Noark Dualbreak Safety Switches provide maximum safety by rupturing the current at *two* separate *points* in each leg. Arc is practically eliminated . . . safety is greatly increased . . . and wear on switching parts is reduced to a negligible point. Skill that is backed by one hundred years of precision manufacturing provides the added margin of safety and dependability that makes Colt-Noark Safety Switches stand out as leaders in their field.

Colt-Noark Dualbreak Safety Switches are built in sizes ranging from 30 amperes up to 1200 amperes . . . all with Quick-Make and Quick-Break and interlocking covers. All have the flat type handles, for close banking when installed in groups.

COLT-NOARK "QUADBREAK" SWITCHES

are similar in construction to the "DUALBREAK" type . . . but break the circuit at *four* points in each leg. Cat. No. 75931 is shown above . . . 100 amperes . . . with Quick-Make and Quick-Break, interlocking cover and flat type operating handle.

COLT'S PATENT FIRE ARMS MFG. CO., Electrical Division HARTFORD, CONN.

100 Years of Manufacturing Experience is back of every Colt Built Product

COLT-NOARK

SWITCHES INDUSTRIAL CONTROL EQUIPMENT FUSES

Boston
New York
Chicago
Philadelphia

Calling all dealers ...WHO WANT TO BE LEADERS

12 BEAUTIFUL HOUSEHOLD MODELS...ALSO A COMPLETE LINE OF COMMERCIAL RANGES WITH THESE SENSATIONAL SELLING FEATURES...

STANDARD *Kalmax* AND STANDARD *Chromalox* SURFACE HEATING UNITS mean more speed...easier cleaning... new even-glow heating ...new flexibility...new economy... new beauty.

In all the 25 years of Standard's history there has never been such a splendid opportunity for distributors and dealers to join forces for present opportunity and future progress. An organization old in experience becomes young in viewpoint . . . determination and *drive!*

The entire Standard line has been revised, re-styled and sensational selling features added. The manufacturing facilities have been enlarged. A program of promotion and advertising has been created to give distributors and dealers every material help necessary to move more merchandise.

The whole Standard program is based upon a plan of partnership pledged to the proposition that every distributor and dealer shall make more sales and profits. The Standard franchise is more valuable today than ever before. A dramatic sales presentation is prepared. Send the coupon and get the complete story. Standard Electric Manufacturing Corporation, Toledo, Ohio.

...lead the parade of profits... mail this coupon Now

STANDARD ELECTRIC MANUFACTURING CORP.
Toledo, Ohio

Please send me full particulars about Standard's new program of profit.

Name _____

Address _____

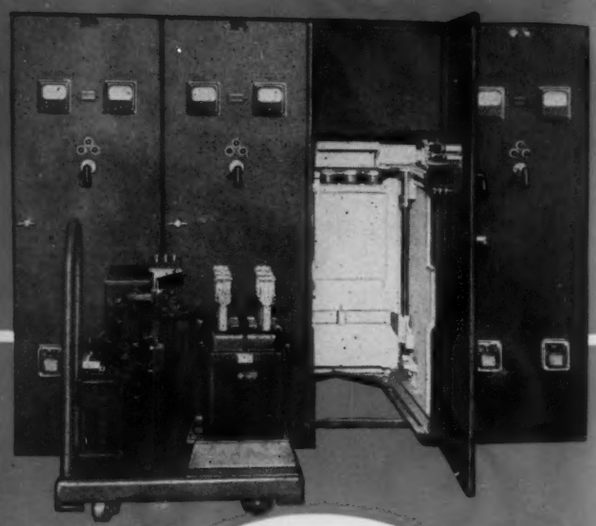
City _____

State _____

KWG

ON YOUR NEXT STATION

save on building costs



USE ALLIS-CHALMERS METAL-CLAD SWITCHGEAR FOR YOUR OIL CIRCUIT BREAKER INSTALLATIONS

and get saving of space—simplification of building requirements—materially lower cost installation

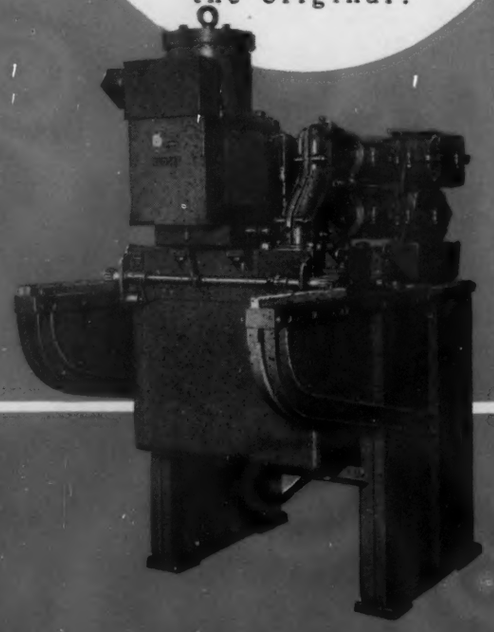
- proven interrupting capacity
- the highest possible degree of safety
- low cost, easy maintenance and inspection
- dependable performance under all service conditions
- elimination of possible human error in the sequence of switching operations

Metal-clad Switchgear is factory built and shipped completely assembled, ready for installation. No specially prepared building necessary—you can save money for structural costs are materially reduced.

When you specifiy Allis-Chalmers Metal-clad Switchgear you get the acknowledged standard in Metal-clad Switchgear design. First introduced in 1924, Allis-Chalmers pioneered Metal-clad construction. It is accepted as standard today, by utilities from coast to coast.

Write for Engineering Bulletin 1145B containing 16 illustrated pages of the latest data on Metal-clad Switchgear design. Learn how you can save on building costs.

All Allis-Chalmers Metal-clad Switchgear is the product of extensive facilities for research, development, and testing which are second to none in the world. In addition it is backed with the longest and broadest Metal-clad Switchgear manufacturing experience in America. Allis-Chalmers are pioneer builders. Specify the original!



SWITCHGEAR DIVISION

ALLIS-CHALMERS

MILWAUKEE·WISCONSIN

OUT OF YOUR CUSTOMER'S SIGHT

The new Chromalox Super-Speed Range Unit manufactured by Edwin L. Wiegand Co., Pittsburgh, Pennsylvania. The smaller disc is the deflector made of Ebonized Monel.

...BUT VERY MUCH IN HER MIND

Housewives know that Chromalox deflectors, though not in view, are an important part of the range...

Turn over the Chromalox unit on any of the ranges listed at right, and you reveal a small part about the size of a saucer. Black as the Ace of Spades and just as shiny, it is made of Ebonized Monel.

Like regular Monel, Ebonized Monel is strong, tough, rust proof, and stoutly resistant to corrosion. Still more important, Ebonized Monel is *immune to discoloration* from heat. Its shiny black finish is produced by oxidizing regular Monel at a temperature of 1900° F. That's far hotter than a deflector can ever become while in use on the range.

The hard oxide coating on Ebonized Monel deflectors is unaffected by the heat of cooking. Ended for good are spotting and discoloration. All the housewife need do to preserve the spotless black lustre is to wash it clean in the regular way.

Next time you demonstrate a Chromalox-equipped range, tell your prospect about the Ebonized Monel deflectors. Write for further information. Address:

Ranges equipped with Chromalox Units and Ebonized Monel Deflectors:

A-B STOVE	ELECTROMASTER	NORGE
COPELAND	ESTATE	PROSPERITY
CRAWFORD	KELVINATOR	QUALITY
CROWN	MARION	UNIVERSAL
	MONARCH	

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York, N. Y.

MONEL

MONEL

"Monel" is a registered trade-mark of The International Nickel Company, Inc., which is applied to a nickel alloy containing approximately two-thirds nickel and one-third copper.

OKOLITE

Resistant to HEAT·MOISTURE·CORONA

A dramatic picture but it shows the destructive processes going on in rubber-insulated cables when the wrong insulation is subjected to corona and extremes of temperature and moisture.

OKOLITE insulation handles these conditions. It is effectively resistant to HEAT, MOISTURE and CORONA. Where it is desired to avoid having a lead sheath, OKOLITE is *the* satisfactory insulation.

OKOLITE insulation meets exacting laboratory tests and is backed with an impressive performance record. Millions of feet of OKOLITE insulated cable are operating in diversified use throughout the country.

OKOLITE insulation can effect large savings in plant construction and maintenance. A study of OKOLITE characteristics and performance will show the wide usefulness of this insulation. Its scope ranges from a small control cable to heavy generator leads —or a submarine power cable.

1938 Marks Our 60th Year of Service

THE OKONITE COMPANY

Founded 1878

EXECUTIVE OFFICE: PASSAIC, NEW JERSEY

HAZARD INSULATED WIRE WORKS DIVISION

THE OKONITE-CALLENDER CABLE CO., INC.

New York Boston Seattle Buffalo Chicago Dallas Detroit Atlanta
Philadelphia Los Angeles Pittsburgh St. Louis Washington San Francisco

OKONITE QUALITY CANNOT BE WRITTEN INTO A SPECIFICATION

This NEW Synchronous

TIME-SWITCH

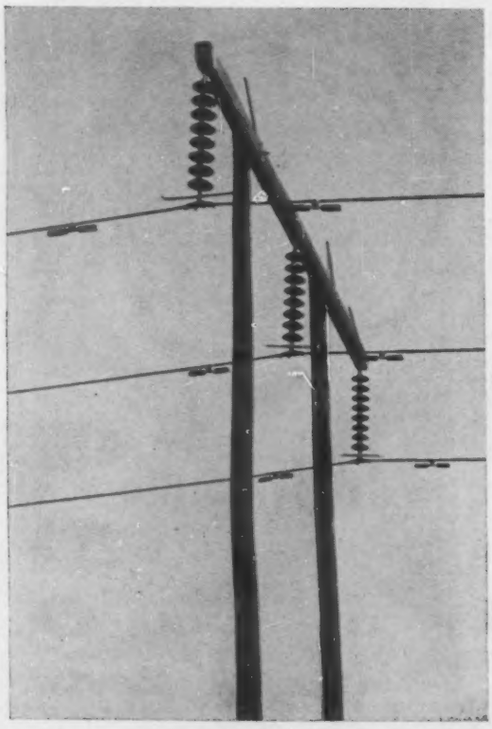
will not stop...

...because the 10 hour carryover feature of SANGAMO FORM VSW assures continued service.

The Model B Forms VSW and VSWZ Time-Switches combine the advantages of synchronous timing with reserve spring clock operation, providing continuous operation during current interruptions up to ten hours. An entirely automatic carryover eliminates the necessity of resetting the dial after the electric service has been restored. Supplied with standard or astronomic dial.

DETAIL DESCRIPTION ON REQUEST

SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS



Even the ground man recognizes the value of A.C.S.R. vibration control. He knows that, regardless of conductor material, a line's a better line when it's protected by Stockbridge Vibration Dampers. With the conductors being Aluminum Cable Steel Reinforced, this line will be on the job long after he's gone where good grunts go.

A.C.S.R. materials and standards have passed, with honors, the most rigid of tests — years and years of actual service, exposed to heat and high winds, cold, sleet and other abnormal loadings. Promises of performance are based on known records of other lines.

Hi-line or rural line, there is an A.C.S.R. conductor which offers the most economical combination of strength and conductivity. Let our engineers assist you on overhead construction problems. ALUMINUM COMPANY OF AMERICA, 2132 Gulf Building, Pittsburgh, Pennsylvania.

[*Hubbard & Co., Emeryville, Calif., is licensed to manufacture and sell all latest type Stockbridge Dampers in Pacific Coast States.*]

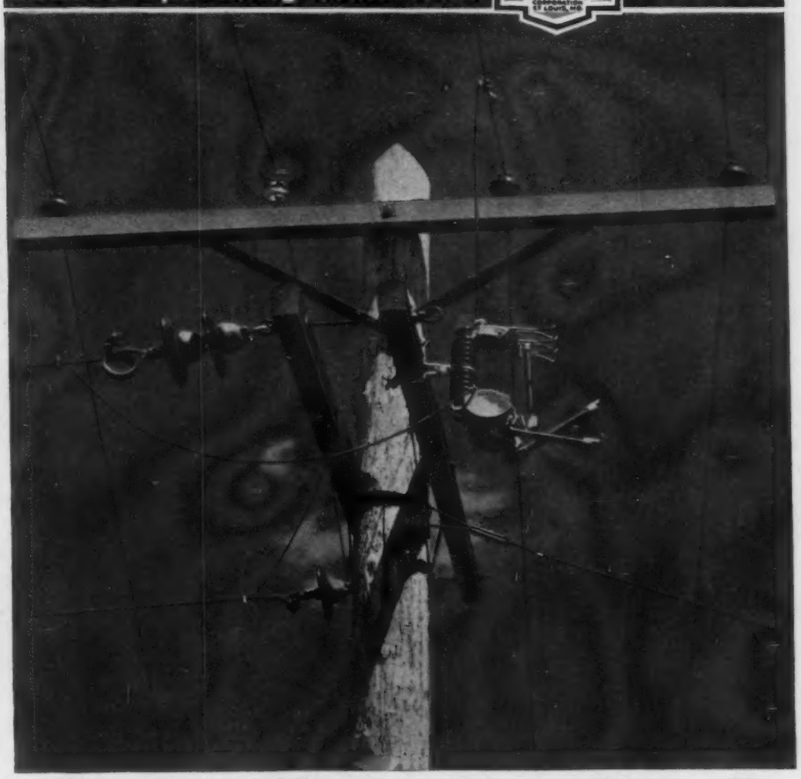
A·C·S·R

FOR RURAL LINES

FOR POWER TRANSMISSION

ALCOA ALUMINUM

Reduce Operating Costs with JAMES R. KEARNEY Products



"There's another patrol trip we saved . . . that Trip-Saver cartridge, in blown position, shows that it cleared a fault."

Lower Interruption Costs Fewer Long, Hard Patrols

— a mighty good reason for a change to Kearney (Reclosing type) Trip-Savers

You need fuse link accuracy for positive protection. Kearney Quik-Action Fuse Links are accurate—within plus or minus 10% of current values—usually within 5%.

GETTING OUT at all hours of the day and night to take care of service interruptions, at isolated locations in the system, was causing crews a lot of trouble . . . reports showed that long, time-consuming patrols were increasing operating costs — service interruptions were reducing revenues.

An alert engineer studied Kearney Trip-Saver Switches . . . Noted that they could be easily installed; were sturdily built, for lasting service; realized that exclusive design features assured positive performance; that the cycle of operation of the cartridges could be started at any one of the cartridges and that the position of the cartridges showed whether or not there had been trouble.

Here was good reason for a change to Kearney Trip-Savers . . . After they were installed, if a fault or overload occurred, the one cartridge in service cleared the trouble — an auxiliary cartridge restored service within 30 to 40 cycles.

Why not take advantage of the savings that Kearney Trip-Savers effect? Investigate . . . or, have our engineers work with you. Write today.

MANUFACTURED BY
JAMES R. KEARNEY CORPORATION
4224-42 CLAYTON AVE. SAINT LOUIS, MO.

Exclusive Sales Representatives

MAYDWELL & HARTZELL
INCORPORATED
LOS ANGELES • SAN FRANCISCO • PORTLAND

EXCLUSIVE DISTRIBUTORS
GRAYBAR ELECTRIC CO., Seattle, Portland, Tacoma, Spokane • WESTINGHOUSE ELECTRIC SUPPLY CO., Phoenix • J. R. BRADLEY CO., Reno

The Jobs you READ about
West Side
Express Highway
New York City
FOR SAFE ARTERIES
of Traffic—or Electricity!
Another job on which THE CONTRACTOR
WAS SAFE because HE SPECIFIED TRIANGLE
TRIANGLE PRODUCTS REWARD BUYERS!
TRIANGLE CONDUIT & CABLE CO., Inc.
Horace Harding & Queens Blvds.
ELMHURST, NEW YORK CITY, N.Y.
PACIFIC COAST DIVISION
C. C. Hillis, Vice-President In Charge of Sales
390 Seventh St., San Francisco, California
ARTERIES FOR ELECTRICAL SYSTEMS
It MUST be right!
NEXT ISSUE
ALAMEDA COUNTY
COURTHOUSE
OAKLAND, CALIF.

WIDE-LIMIT

THIS is an accurately reproduced curve of the most accurate watthour meter in existence today—the G-E wide-limit watthour meter.

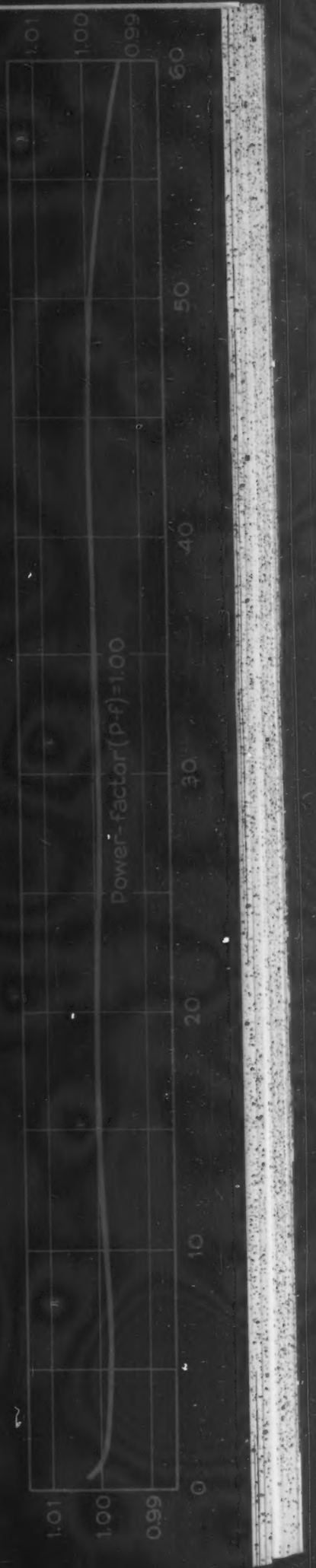
It is the performance curve of the Type I-30 single-phase watthour meter rated 15 amperes, 240 volts, 3-wire. It shows that the I-30 meter has an almost straight-line characteristic between the wide-apart limits of 0.5 and 60 amperes. It also shows why this one meter is suited for both large and small single-phase loads and thus reduces inventory investment, keeps down maintenance, and protects revenue.

Investigate the advantages of making the Type I-30 (A or S) your standard. Send for Bulletin GEA-2721A, which gives details and prices; or call a G-E meter specialist. Address nearest G-E sales office or General Electric Company, Dept. 6—201, Schenectady, New York.

The heart of the I-30 meter

GENERAL ELECTRIC

400-30



PLEASE TURN MAGAZINE THIS WAY

When driving

COPPERWELD

non-rusting GROUND RODS

The only tool you need is a hammer

NO special driving tools are needed with Copperweld Ground Rods. Your men can easily drive even the smaller sizes—such as half-inch by eight foot—without the rods bending. The rigid core of special steel takes care of that.

Labor costs are lower with Copperweld Rods, and losses from scrapping bent or deformed rods are practically nil.

Because the top ends of all Copperweld rods are chamfered to reduce "mushrooming" during driving, the clamps may be slipped over the tops of the rods *after driving.*

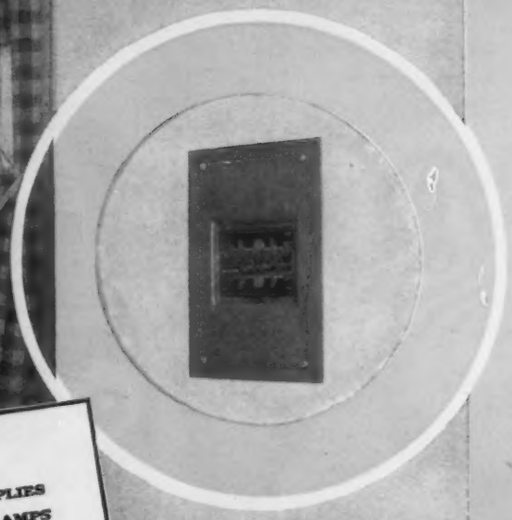
And Copperweld Type B Clamps provide the simplest, most dependable and economical means of connecting the grounding wire to the rod.

Have you received your copy of the new Copperweld Ground Rod and Clamp Data Book? If not, just ask for it on your company letterhead. Specify Copperweld Ground Rods and Clamps for economy and dependability.

COPPERWELD STEEL COMPANY

Glassport, Pa.

COPPER · BRONZE · COPPERWELD RODS, WIRE, AND STRAND



LIGHTING FIXTURES
MEDICINE CABINETS

WIRING SUPPLIES
FANS · LAMPS

ANDERSON ELECTRIC & SUPPLY CO.

COR. 5TH & COLLEGE STS. CHARLOTTE, N. C.

Oct. 13, 1937

Mr. Burton F. Buchan
c/o Square D Co.
Charlotte, N. C.

Dear Sir:

We have been using MULTI-BREAKERS as standard equipment for the past six months, and feeling that you might like to have ours, as well as our customers reaction, to their merit, advise as follows.

To start with we feel that any firm serving the public should furnish the latest type of equipment that the market affords, both from the standpoint of service and protection and initial cost and service cost, and we feel that MULTI-BREAKERS have both of these qualifications and in addition protect the installation after the job is completed.

Although some contractors might feel that MULTI-BREAKERS are higher in price than other type equipment, our findings are that savings that can be effected in installation methods, will more than off-set these small differences, not to mention gratis service trips, caused by other equipment and advertising value of customers good will.

In small residences, we find one of the main installation savings is effected by mounting flush type MULTI-BREAKER over range in kitchen, which usually cuts down length of main feeder and in addition the point of lighting protection and control is far more convenient than former out dated locations, to wit: rear porches or basement stairs.

In large residence installations, many practical uses, too numerous to mention here, of MULTI-BREAKERS can be effected which will add to the protection of the job as well as make for more convenient control.

In commercial lighting, MULTI-BREAKERS can be placed at convenient points, and used, not only as positive and automatic circuit protection, but also as switch control for lighting with full assurance that they will make and break their full rated capacity continuously.

In conclusion we are pleased to advise that of the approximately 200 MULTI-BREAKERS we have installed, not one has given trouble in any manner what so ever--truly an enviable record for any automatic device.

Wishing you every success and with best personal regards, we are

Very truly yours,

ANDERSON ELECTRIC & SUPPLY CO.

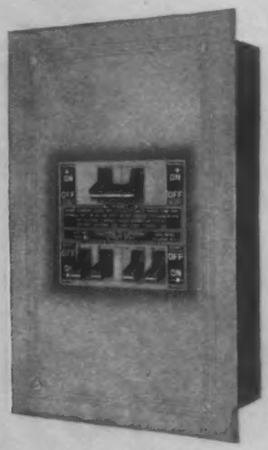
BY Wm. T. Anderson

...N AND MANUFACTURE LIGHTING FIXTURES FOR SPECIAL REQUIREMENTS"

200 INSTALLATIONS 100% PERFORMANCE

Mr. Anderson's letter is well worth reading—every word of it. Basically, his experience is identical with that of progressive contractors the country over, who are taking wiring jobs out of the price class and away from competition by selling the Square D Multi-breakeR and the idea of adequate wiring. When Multi-breakeRs are not specified—figure both ways.

If you are not fully acquainted with the Square D Multi-breakeR, write for Bulletin CA-543A.



CALL IN A SQUARE D MAN

SQUARE D COMPANY

LOS ANGELES - MILWAUKEE - DETROIT

IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO

NOW

TAKE THESE IDEAS HOME . . .

NEW RED SEAL WIRING

AT the recent convention of the Pacific Coast Electrical Association we heard two ideas vigorously promoted. One was the idea of *selling UP* when estimating a wiring installation; the other was selling adequate, sight-saving illumination to schools.

For the benefit of readers who did not attend, the speakers presenting the wiring story emphasized that wiring must be sold not for what it is *but what it will do,* for the labor-saving *convenience* and the vastly improved *lighting* it brings.

Above all they urged adherence to a uniform *minimum* standard as laid down in the new Red Seal Plan . . . with the provision that all bids on a given job shall apply to *identical specifications.*

DEALERS: If you wish further information about either or both of these promotions, communicate with your local P.G.&E. office. Literature on the new Red Seal Plan is available free. Copies of American Recommended Practices of School Lighting are twenty-five cents each.

THAT IT'S OVER • • •

. . . and SELL 'EM

ADEQUATE SCHOOL LIGHTING

LIGHTING and eyesight specialists gave another remarkable presentation to show how a child's *eyesight* and *progress in school* is affected by lighting conditions.

Figures were advanced to show why and where this market exists and how to get at it. Dealers were urged to get a copy of the new bible on school lighting—AMERICAN RECOMMENDED PRACTICES—and then take every opportunity to interest superintendents, school boards and parent-teacher groups in the *benefits* of proper lighting.

We might add that the P. G. and E., as well as the larger manufacturers, has a staff of lighting specialists to assist in the technical phases of this promotion. The main need is for *local initiative*.

P·G·and E·

PACIFIC GAS AND ELECTRIC COMPANY

Owned . Operated . Managed by Californians

EW 106-638

Lapp Insulator Co., Inc.
Le Roy, New York

Gentlemen:

On one of our lines in the southern part of the State, we have a 33 Kv line that runs alongside a gravel road. For several years during the summer vacations a gang of boys has used the insulators on this line for target practice. Annually the insulator replacement bill has run from $300 to $600.

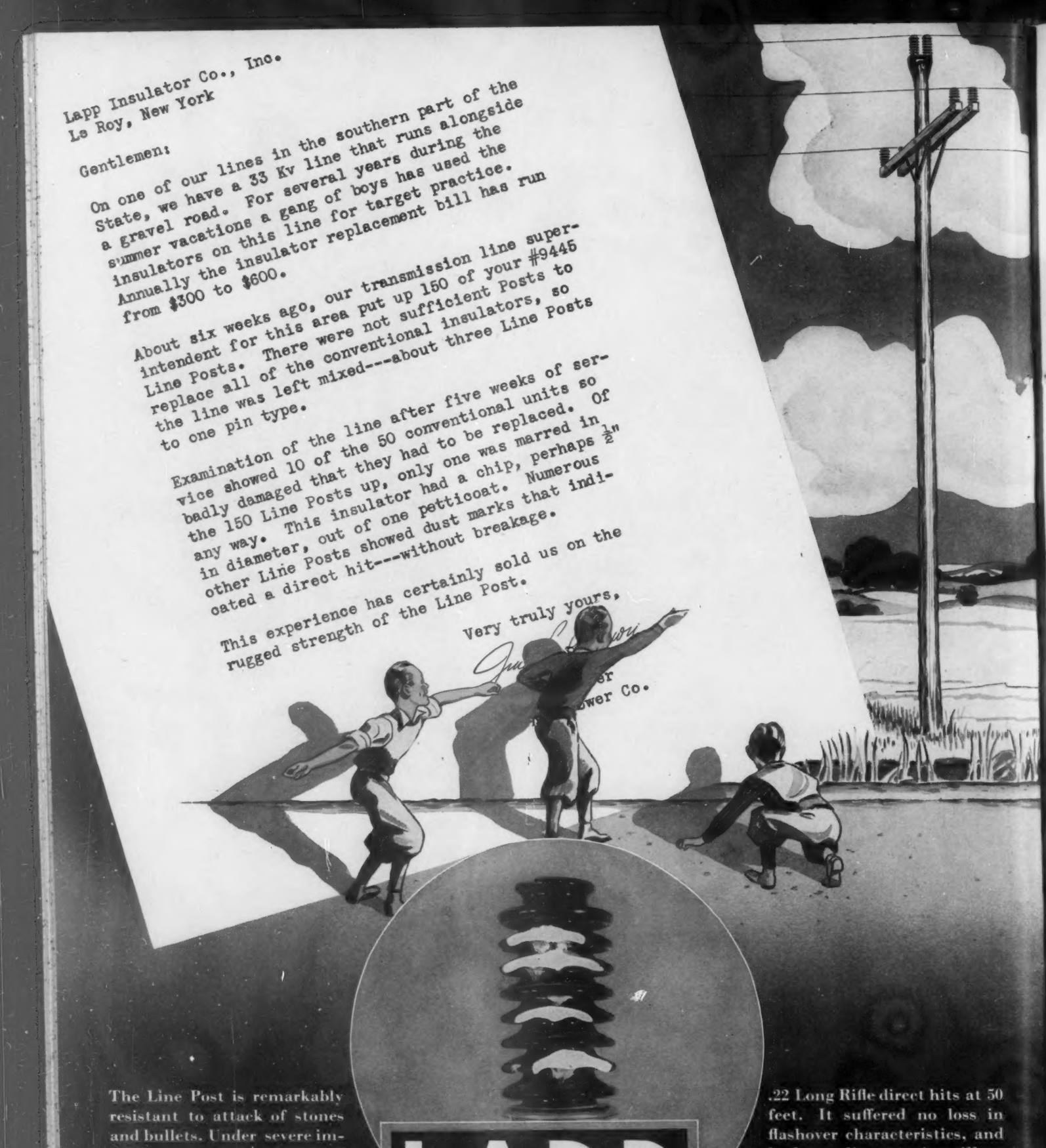
About six weeks ago, our transmission line superintendent for this area put up 150 of your #9445 Line Posts. There were not sufficient Posts to replace all of the conventional insulators, so the line was left mixed---about three Line Posts to one pin type.

Examination of the line after five weeks of service showed 10 of the 50 conventional units so badly damaged that they had to be replaced. Of the 150 Line Posts up, only one was marred in any way. This insulator had a chip, perhaps $\frac{1}{2}$" in diameter, out of one petticoat. Numerous other Line Posts showed dust marks that indicated a direct hit---without breakage.

This experience has certainly sold us on the rugged strength of the Line Post.

Very truly yours,

Jas. [illegible]
[illegible]
[illegible]ower Co.

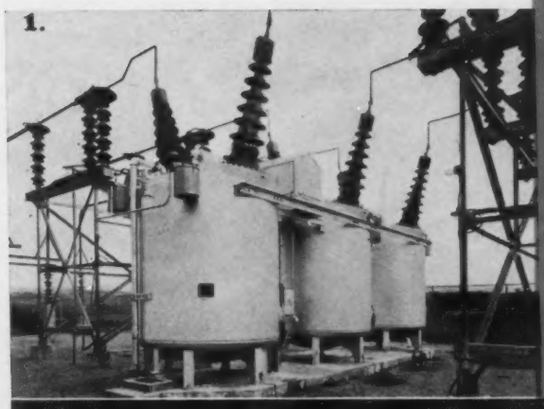


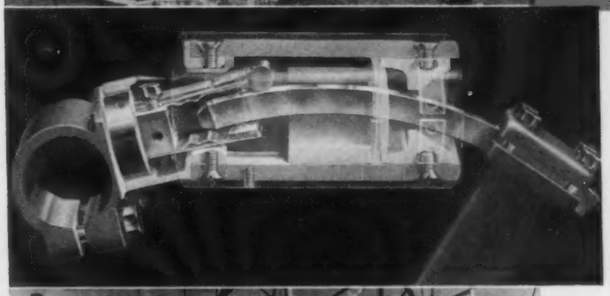
The Line Post is remarkably resistant to attack of stones and bullets. Under severe impact, petticoats will break off without cracking the body. This insulator received seven .22 Long Rifle direct hits at 50 feet. It suffered no loss in flashover characteristics, and leakage distance is still as great as that of a conventional insulator of the same rating.

LAPP INSULATORS

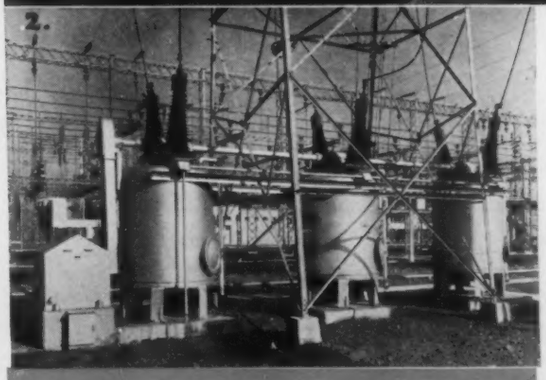
LAPP INSULATOR CO. INC — LE ROY - N.Y. - U.S.A.

With Our EXPULSION CHAMBERS *it's often* More Economical to Rebuild *than to Replace Oil Circuit Breakers*



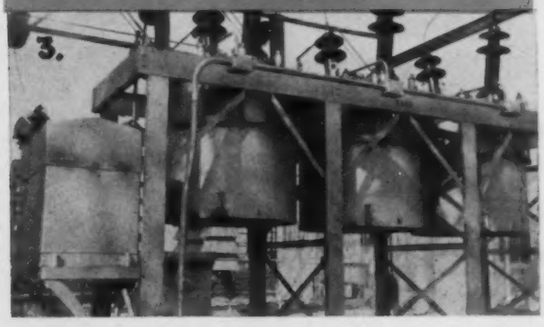


- a. *Short Arcing Time*
- b. *No Contact Burning*
- c. *Less Oil Carbonization*
- d. *No Oil Throw*



A FEW BREAKERS WE HAVE REBUILT

1. Rebuilt 196/230 kv. breaker in southern California
2. Rebuilt 115-kv. breaker in northern California
3. Rebuilt 69-kv. breaker in Texas



There are hundreds of breakers in use today that can be successfully brought up-to-date by rebuilding with our Expulsion Chambers.

Old breakers which do not extinguish arcs quickly are costly to maintain. They may cause serious trouble. However, you can have the added safety and improve your breakers so that they are of adequate capacity to meet present-day conditions—with remarkable improvement in operating characteristics—by equipping your present breakers with Expulsion Chambers which have proved so successful in our modern Oil Circuit Breakers.

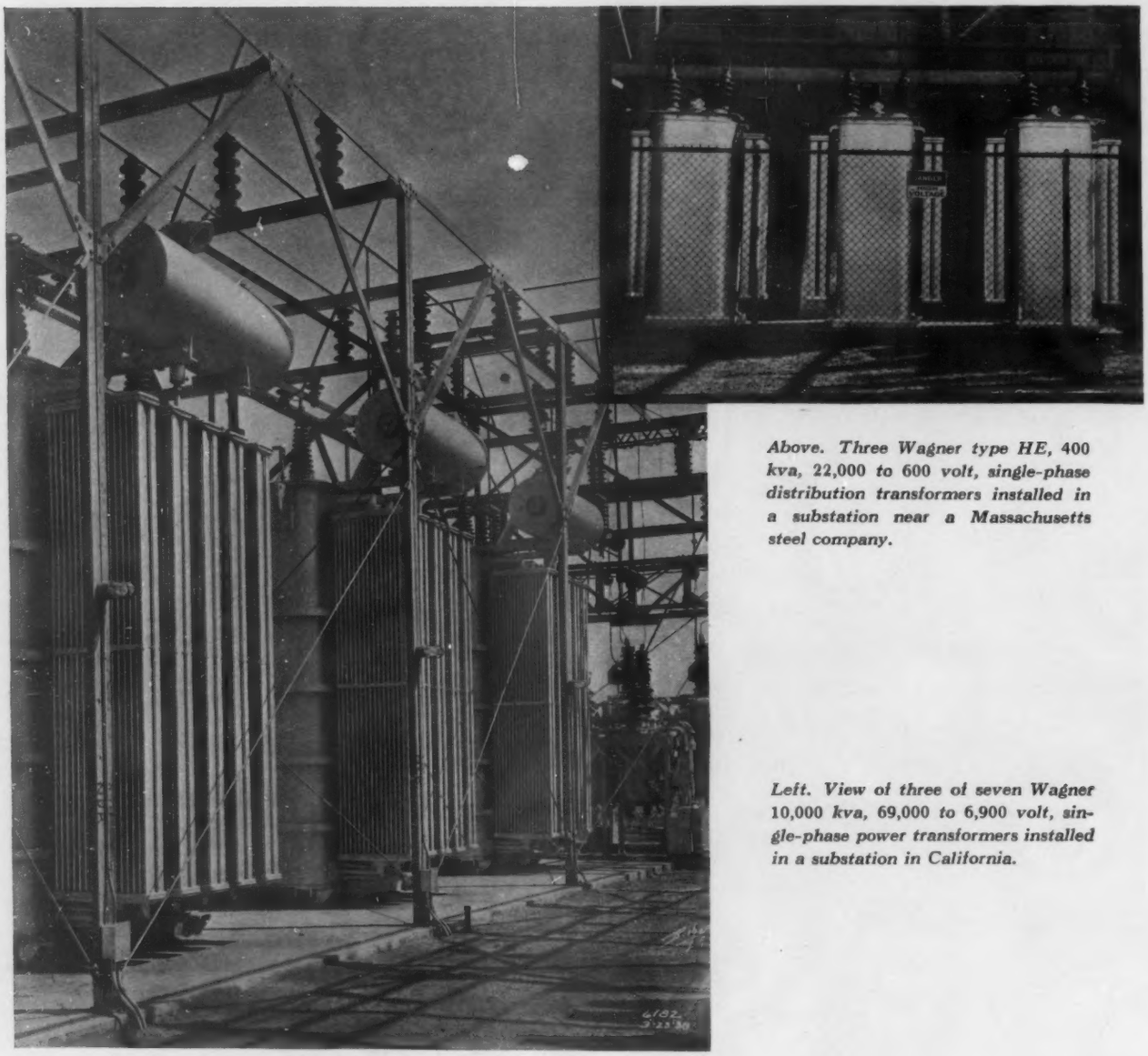
Years of reliable operation with fast arc extinguishing is assured with the Expulsion Chambers. Scores of utilities, the nation over, rely upon them.

We will gladly examine your present breakers and make recommendations.. More than fifty breakers, from 15 kv. to 230 kv., have already been rebuilt and are now giving excellent improvement in line protection—at a saving in maintenance. Write today for full details about our rebuilding plan.

Pacific Electric Mfg. Corporation

5815 Third St., San Francisco · Dunes Highway, Gary, Indiana

REPRESENTATIVES IN PRINCIPAL CITIES



Above. Three Wagner type HE, 400 kva, 22,000 to 600 volt, single-phase distribution transformers installed in a substation near a Massachusetts steel company.

Left. View of three of seven Wagner 10,000 kva, 69,000 to 6,900 volt, single-phase power transformers installed in a substation in California.

Wagner Transformers Are at The Key Points of Power Distribution

● **Substations are key points in the distribution of power of any electric light and power system . . . They're the spots that are vital to an operating company, for a breakdown at one of these places means a failure of electric service to an industrial plant or to a large portion of the distribution system.**

Substations are sites where dependable transformers must be located . . . transformers such as Wagner's, that are able to give continuous, trouble-free, economical performance at all times and in all types of weather. The above illustrations show two Wagner transformer substation installations. Wagner transformers for substations are available in any size, type or rating.

Valuable Catalogs on Wagner Transformers are Free Upon Request. State Whether You Want Our Catalog on Distribution or Power Transformers. →

TT438-1B

Wagner Electric Corporation

6400 Plymouth Avenue, Saint Louis, U.S.A.

MOTORS TRANSFORMERS FANS BRAKES

IN EVERY PART OF TOWN

G-E WIRING MATERIALS

FIT THE JOB

Whatever type of building you wish to wire, whether it be an office building, a factory, a home or a roadside stand, you'll find exactly the right wiring materials in the G-E line. These materials — conduit, wiring devices, wire and cable — all have the same uniform high quality and are designed to be used together. G-E Wiring Materials are economical, easy to install and assure long years of service.

For more information about General Electric Wiring Materials, see your nearest G-E Merchandise Distributor or write today to Section CDW-8212, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.

GENERAL ELECTRIC

WIRING MATERIALS

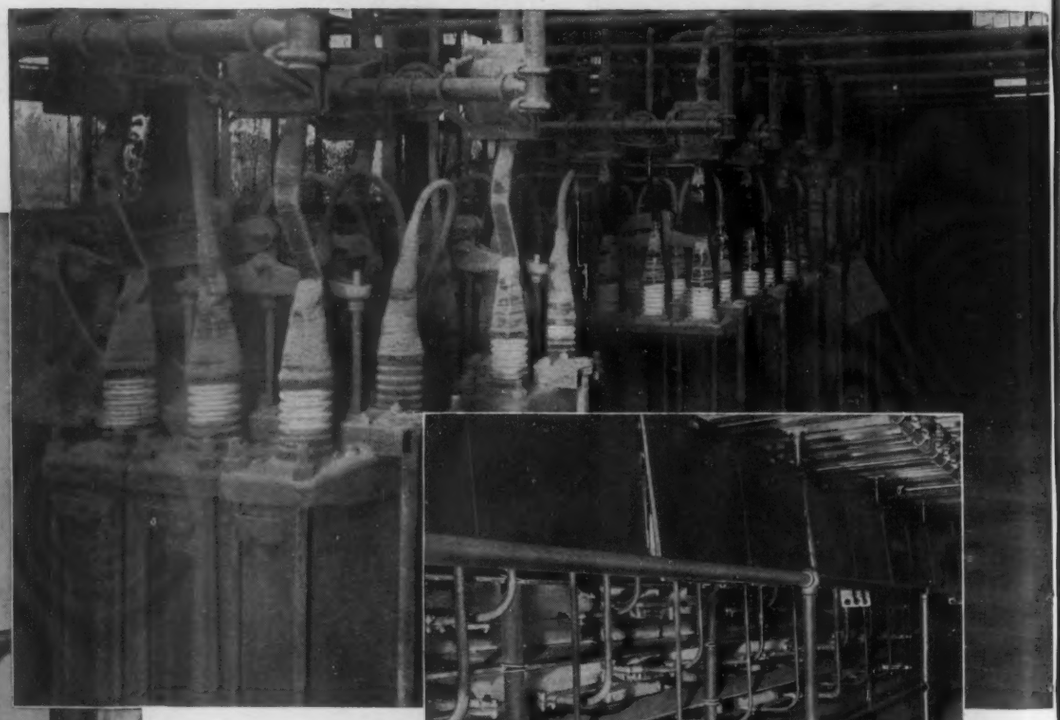
APPLIANCE AND MERCHANDISE DEPARTMENT, GENERAL ELECTRIC COMPANY, BRIDGEPORT, CONNECTICUT

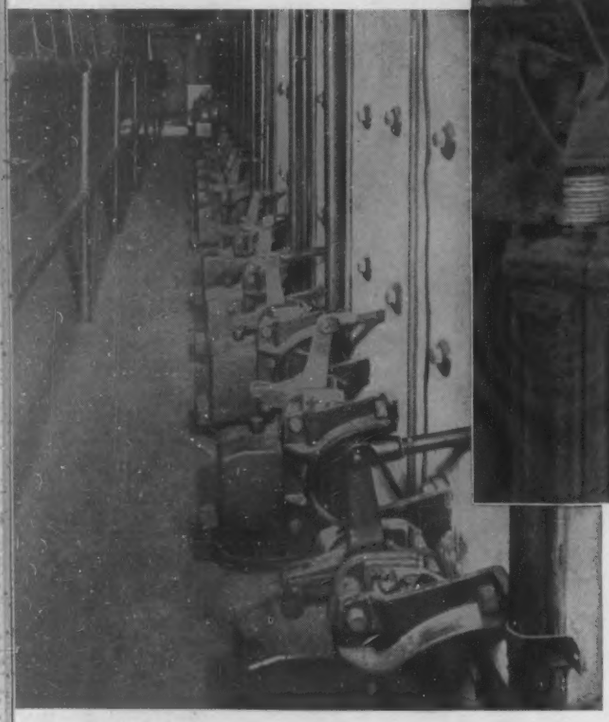
IT SEEMS ONLY YESTERDAY

— *When This Was Standard Practice*

Exposed oil circuit breakers and connections

Breaker solenoid operating mechanisms exposed in the aisle





Exposed live bus sections — hook-operated switches above

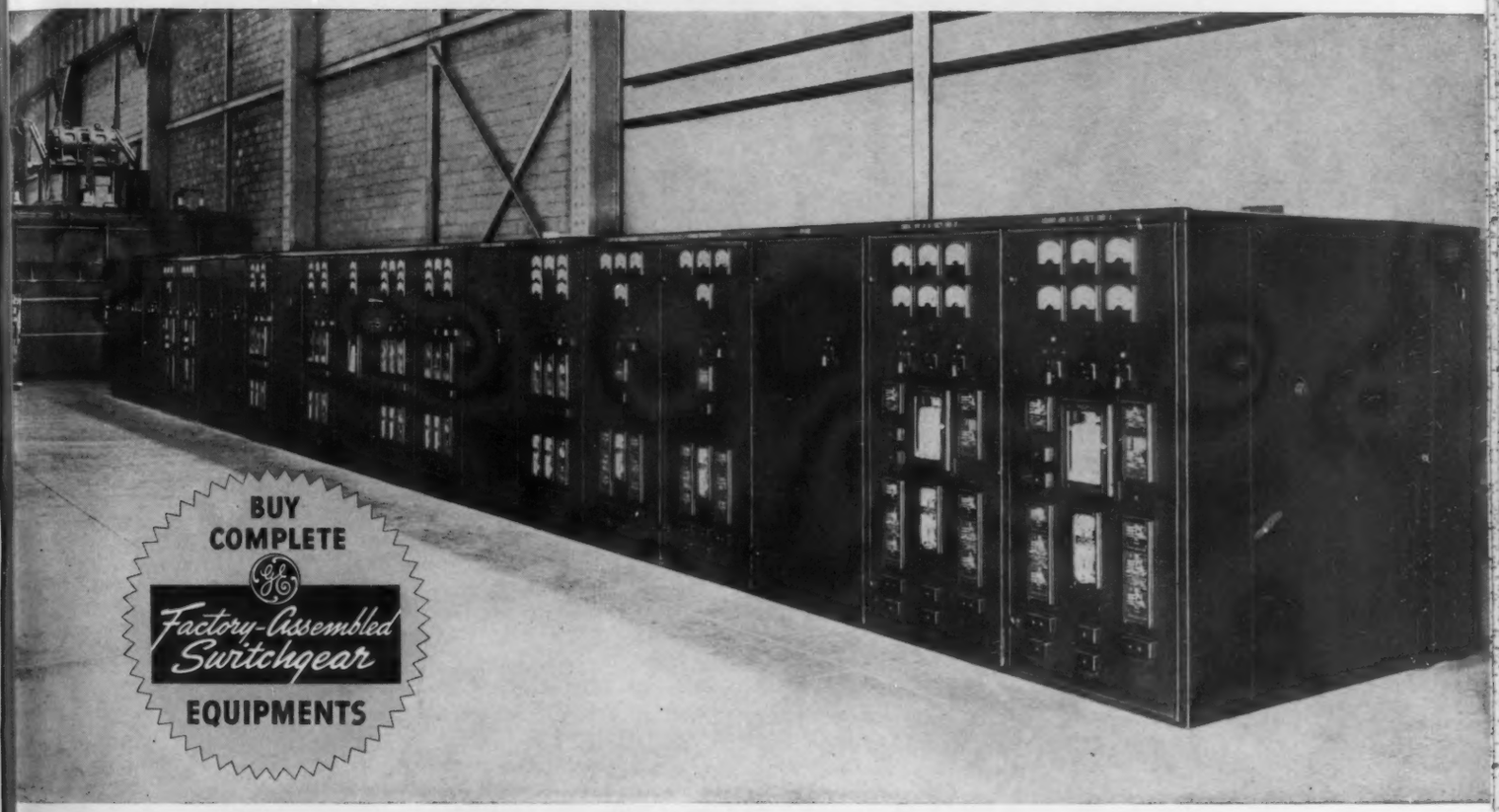
This type of switchgear isn't adequate today

GENERAL

Filing No. 7300

But Today

What a difference!



Modern Switchgear Means Safety and Low Installation Cost

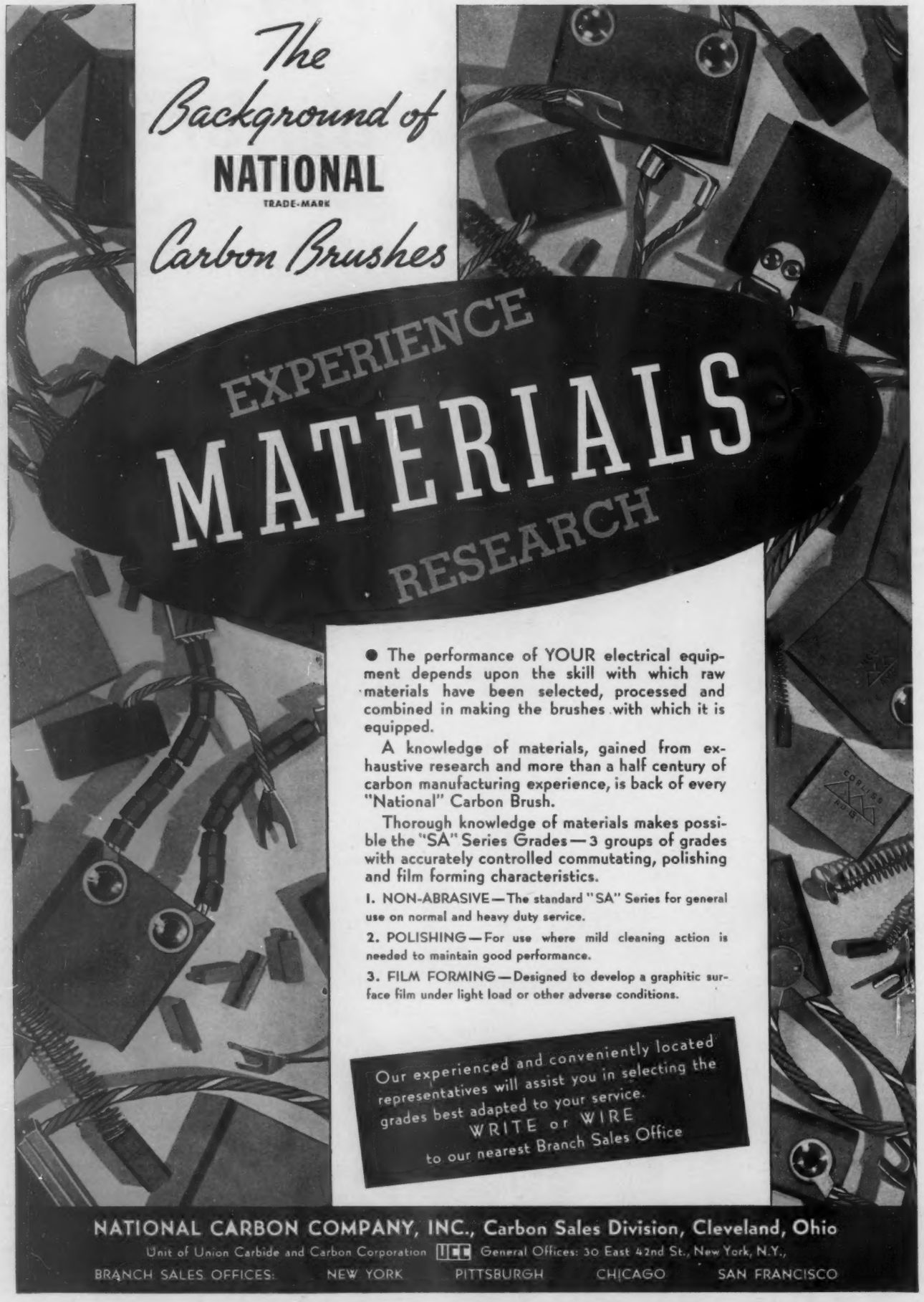
METAL-ENCLOSED switchgear, built and shipped as a unit, is ready for operation on arrival at your door. Modern gear avoids expensive construction delays—the inevitable result of piecemeal buying—and you save on installation costs. Even more important, you are assured of reliable operation, because one manufacturer has designed the whole equipment—a co-ordinated unit, with devices that are all designed to work together.

The switchgear above is METAL-CLAD. Standard up to 15,000 volts and 500,000 kva. Has the distinctive feature of easily removable breakers. A completely insulated, safety-interlocked, conservatively rated gear, and shipped completely assembled. Described in Bulletin GEA-2499, copy on request. General Electric, Schenectady, N.Y.

GE

ELECTRIC

890-63


The Background of
NATIONAL
TRADE-MARK
Carbon Brushes
EXPERIENCE
MATERIALS
RESEARCH
● The performance of YOUR electrical equipment depends upon the skill with which raw materials have been selected, processed and combined in making the brushes with which it is equipped.
A knowledge of materials, gained from exhaustive research and more than a half century of carbon manufacturing experience, is back of every "National" Carbon Brush.
Thorough knowledge of materials makes possible the "SA" Series Grades — 3 groups of grades with accurately controlled commutating, polishing and film forming characteristics.
1. NON-ABRASIVE — The standard "SA" Series for general use on normal and heavy duty service.
2. POLISHING — For use where mild cleaning action is needed to maintain good performance.
3. FILM FORMING — Designed to develop a graphitic surface film under light load or other adverse conditions.
Our experienced and conveniently located representatives will assist you in selecting the grades best adapted to your service.
WRITE or WIRE
to our nearest Branch Sales Office
NATIONAL CARBON COMPANY, INC., Carbon Sales Division, Cleveland, Ohio
Unit of Union Carbide and Carbon Corporation
General Offices: 30 East 42nd St., New York, N.Y.,
BRANCH SALES OFFICES: NEW YORK PITTSBURGH CHICAGO SAN FRANCISCO

REDUCES CENTRAL STATION SERVICE COSTS

For each installation of Westinghouse Nofuze Circuit Protection, the service cost of replacing fuses may be crossed off the books — permanently.

This modern method brings circuit protection up to date, simplifying it to a simple flip of the handle. Service calls for fuse replacements in Nofuze equipped homes are eliminated entirely and the customer is better satisfied.

Nofuze circuit protection is tamperproof, and for the central station, it diverts the fuse replacement service charges, to profit.

Complete information available from your nearest Westinghouse sales office or wholesaler.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO.
EAST PITTSBURGH, PA.

One of Niagara Hudson's Five Star homes — built to specifications based on a survey of 250,000 customers of this great power company. All have adequate wiring and fuseless circuit protection.

J 60204

Westinghouse

NOFUZE MULTI-BREAKERS

YOU'LL FIND A LOT IN DELTABESTON WIRE AND CABLE

It's easy to see some of the features that make Deltabeston Wire and Cable dependable. A glance shows that insulation is uniform . . . finish is smooth. Bending a piece of Deltabeston two or three times proves its flexibility.

But, things that you don't see . . . *hidden assets* . . . are even more important. Greater heat resistance, for example, is assured by asbestos insulation that is *Purified*. Cracks, breaks and seams are eliminated because the insulation is *Felted* to the conductors.

Deltabeston advantages . . . apparent or hidden . . . shouldn't be overlooked. They mean efficient operation . . . fewer breakdowns. They mean reliable production schedules, in spite of constant heat and hurry.

There's a Deltabeston Catalog that you should have. It contains helpful facts about the complete line of Deltabeston Wires and Cables. Write for it. Address Section Y-8216, Appliance and Merchandise Dept., General Electric Co., Bridgeport, Conn.

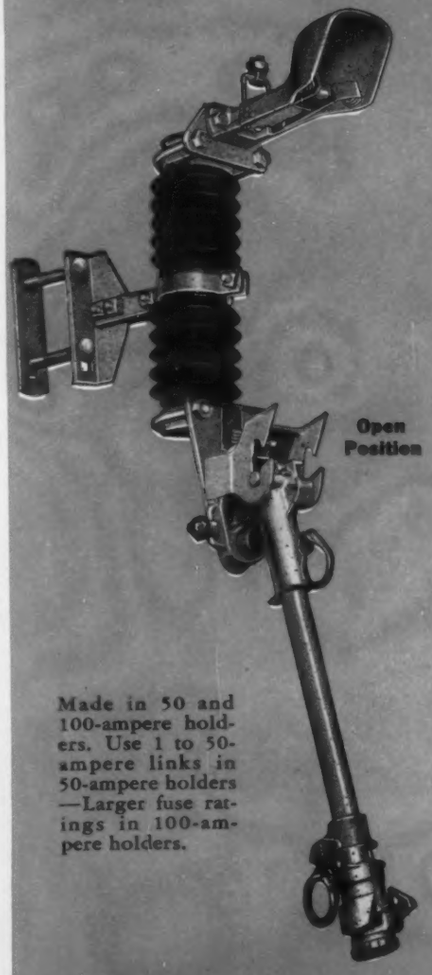
Deltabeston Asbestos-insulated Conductors for every requirement are distributed by General Electric Merchandise Distributors and Graybar Electric Company.

GENERAL ELECTRIC

SHORTER ARCING TIME • • •

When an S&C Cutout blows, the spring collapses and interruption of the circuit is instantaneous.

S&C SEMAFOR CUTOUTS
Open Type. Made in Light, Medium and Heavy Duty Types—5,000 to 46,000 V., 50 and 100 Amps. Semafor action signals when fuse is blown. Also made in Recloser Fuse assemblies.



Open Position

Made in 50 and 100-ampere holders. Use 1 to 50-ampere links in 50-ampere holders —Larger fuse ratings in 100-ampere holders.

Since S & C design places the link at the *lower end* of the tube, the fault is cleared faster. There is no hanging on of the arc up inside the tube, because the link is not pulled down the full length of the tube to the exhaust end. . . . Both these features contribute to shorter arcing time.

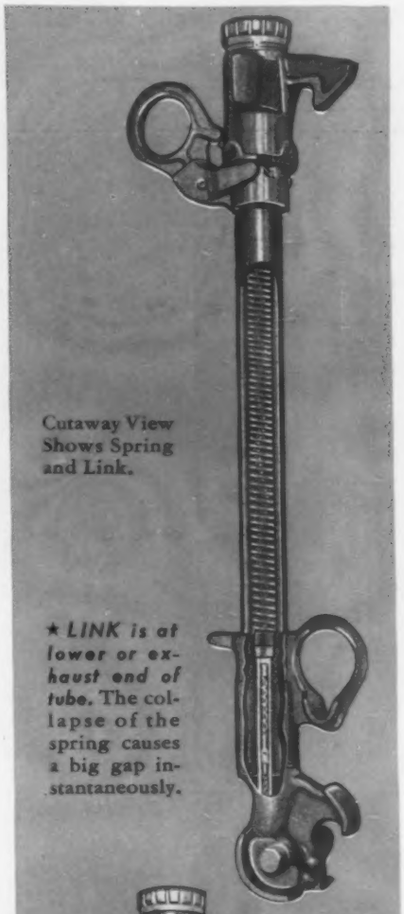
You actually reduce the cost of maintenance and replacements—you get assured protection, with S & C Semafor Cutouts.

Equip a selected area of your distribution system with them for comparison.

WESTERN REPRESENTATIVES
San Francisco:
Geo. E. Honn, 420 Market Street
Los Angeles:
Farnham & Cunningham, Edison Bldg.
Seattle:
T. S. Wood, 220 Ninth Street, North
Salt Lake City:
Riter Engineering Co., Kearns Bldg.

SEMAFOR

CUTOUTS

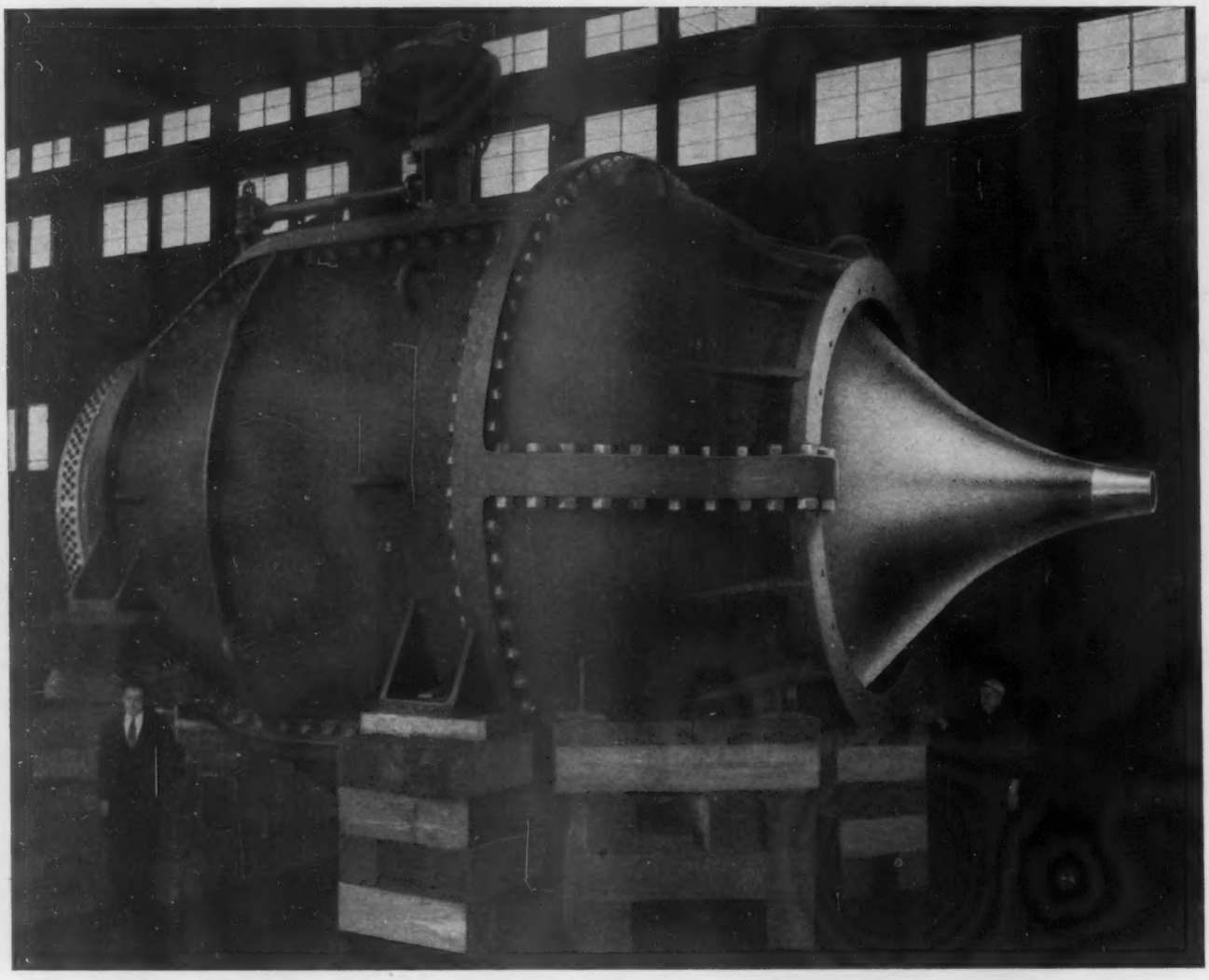


Cutaway View Shows Spring and Link.

★ *LINK is at lower or exhaust end of tube.* The collapse of the spring causes a big gap instantaneously.

Same view showing spring collapsed, and link expelled.

SCHWEITZER & CONRAD, Inc.
4435 Ravenswood Ave., Chicago, Ill.
Manufactured in Canada by Powerlite Devices Ltd., Toronto, Ont.



180 Tons of Steel and Bronze

Unprecedented in size and weight for valves of their kind, two balanced-plunger, Larner-Johnson type, free discharge regulators, designed by Pelton engineers and manufactured in San Francisco, will soon be installed in the outlet works of San Gabriel Dam No. 1, Los Angeles County Flood Control District. Under full static head, each will discharge 5600 cubic feet per second in a solid ten-foot jet.

The regulators are 25 ft. in height, 30 ft. long and weigh 360,000 lbs. each. When hydrostatically tested to 215 lbs. sq. in. both valves were found to be practically drop tight, indicating the extreme accuracy with which Pelton design and shop construction was carried through, and the excellence of the material used. Four cars were required for shipment of each valve.

THE PELTON WATER WHEEL COMPANY

HYDRAULIC ENGINEERS

120 Broadway
New York

2929 Nineteenth Street
San Francisco

Paschall Station
Philadelphia

EXCLUSIVE WESTERN REPRESENTATIVES for Baldwin-Southwark Corp., De La Vergne Engine Co., Cramp Brass & Iron Foundries Co., Woodward Governor Co., and Cone Valve Division, Chapman Valve Mfg. Co.

PELTON

CHROMALOX Super-Speed

THE RANGE UNIT THAT HAD A FLYING START.

FIRST (and still the only) SUPER-SPEED UNIT

FIRST (and still the only) ALL-FLAT-TOP UNIT OF EFFICIENT EMBEDDED WIRE TYPE

FIRST (and still the only) "TWO-UNITS-IN-ONE" UNIT PROVIDING UNEQUALED SPEED AND ECONOMY WHEN SMALL UTENSILS ARE USED

BASICALLY RIGHT FROM THE BEGINNING

Chromalox Super-Speed range units have from their initial appearance enjoyed exclusive and powerful advantages beyond successful imitation. They are FIRST in the designation SUPER-SPEED—a name that accurately describes the rapidity of their cooking . . . FIRST in flat-top efficiency, cleanliness, and convenience . . . FIRST in the wide area surface contact that transmits heat the fastest way known to science.

But Chromalox engineers are never satisfied. They are constantly striving for improvement, with the result that the Chromalox unit of today, while basically the same as the original Chromalox unit, is vastly better looking and more efficient.

The range manufacturers who supply these units on their product, the dealers who sell them, the housewives who cook with them, all are confident that they have the unit which is the standard-bearer of modern electric cooking.

Write us or our nearest representative

MONTGOMERY BROTHERS
911 Western Ave., Seattle, Wash. • 1501 N.W. Kearny St., Portland, Ore. • 61 Fremont St., San Francisco, Cal., 912 E. Third St., Los Angeles, Cal.

THE PETERSON COMPANY • 1921 Blake St., Denver, Colo.

EDWIN L. WIEGAND CO. 7540 Thomas Blvd. Pittsburgh, Pa.

PARTNERS IN PROGRESS . . . ONE OF A SERIES

WATCH DOG

For urban, suburban or rural distribution, the CSP Transformer requires no excess installation capacity—will handle even the surge currents of direct lightning strokes.

The CSP Transformer, developed by Westinghouse to help reduce outages and improve service, is an effective protector of power company good will and profits.

For years, many distribution engineers felt that outages and resulting maintenance due to lightning could be reduced if lightning protection could be built into distribution transformers. They brought their problem to Westinghouse.

Westinghouse engineers, with an active interest in the improvement of electric service, went to work. The development of the SP and later the completely self protecting transformer was the result. This CSP transformer, with built-in "De-ion" gaps for lightning protection and a circuit breaker for overload protection, has given the electrical industry a remarkable "watch dog" over costs and outages. It effects substantial savings in maintenance, practically eliminates outages, yet the installed cost due to the self-contained design is often lower than protected conventional types.

Such developments as the CSP result from an intimate knowledge of electric service problems and the fact that the industry's engineers look upon Westinghouse as a *partner,* rather than an ordinary supplier of apparatus.

J-93128

WESTINGHOUSE ELECTRIC

Westinghouse

FROM ANY ANGLE

Hemingrays mean long *Trouble-Free* performance at moderate cost

Greater Leakage Distance *plus* the BRASS BUSHING!

● The modern design of HEMINGRAY Glass Insulators, Series-600, provides the greater leakage distance that assures outage-free performance at all times. The brass bushing means greater mechanical strength. The tougher glass means defiance to age and resistance to harder usage. The more accurately controlled manufacturing processes mean uniform production. These four advantages *together* mean unfailing service throughout the years at minimum cost. Send today for samples.

3 SIZES

TYPE 660...FOR VOLTAGES UP TO 8,000
TYPE 670...FOR VOLTAGES UP TO 10,000
TYPE 680...FOR VOLTAGES UP TO 15,000

Handle most PRIMARY line requirements

World's largest manufacturers of glass containers; and producers of INSULUX Glass Block, DUST-STOP Replacement-Type Air Filters, FIBERGLAS Insulating Wool, Insulating Blankets and Filter Cloth.

Owens-Illinois Glass Company, "FIRST IN GLASS", Hemingray Division, Muncie, Indiana.

FOR MODERN POWER LINE INSULATION

Order HEMINGRAY Glass INSULATORS

5 ESSENTIALS OF A MODERN HOME

- ✓ Adequate Wiring . . .
- ✓ Correct Lighting . . . .
- ✓ Up-to-date Kitchen . .
- ✓ Automatic Hot Water
- ✓ All-year Air Conditioning.

MR. DEALER:
MR. JOBBER:
MR. ENGINEER:
MR. CONTRACTOR:
MR. MANUFACTURER:

Count yourself in on this program. It is all-inclusive in the industry, and complete for the homekeeper.

Throughout the year, this program is publicized in advertising, promoted through sales effort, demonstrated in home service, and engineered for customers and prospective builders.

With concerted support of the electrical industry, there can be no question of success. The plan offers everything the homekeeper wants and gives the industry something long desired.

SAN JOAQUIN POWER

SAN JOAQUIN LIGHT AND POWER CORPORATION

LONG TIME ACCURACY

That means just what it says — accuracy over a longer term of years. It's the kind of accuracy you might look for in a steel yardstick, that always measures a yard, under any conditions — even when it gets old!

Important to you in buying meters? Certainly, because it saves money.

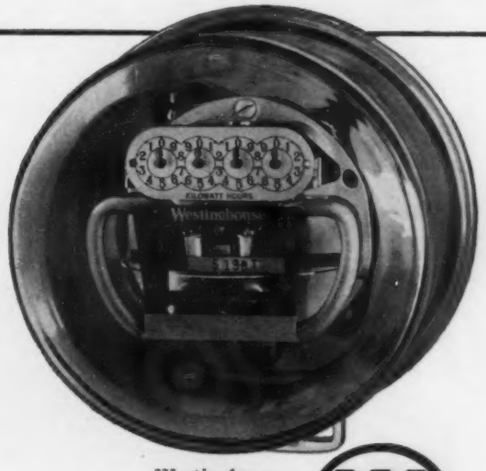
There isn't any mystery about such accuracy in Westinghouse meters. We build them that way . . . simplified design . . . accurate workmanship. They cost more to build, but they come to you without a price premium.

Westinghouse ball and jewel bearings really *last* lifetime without servicing, lubrication or replacemen

Register is gold plated and will not corrode; a one-piec electromagnet assures fixed accuracy characteristic

The proof? Look at your own records. See how Westin house meters serve without requiring adjustment or repai

Make sure you are taking advantage of the econom of these meters. Talk to a Westinghouse man or writ to Westinghouse Electric & Manufacturing Compan Department 7-N, East Pittsburgh, Pennsylvani



Westinghouse
CS Meter

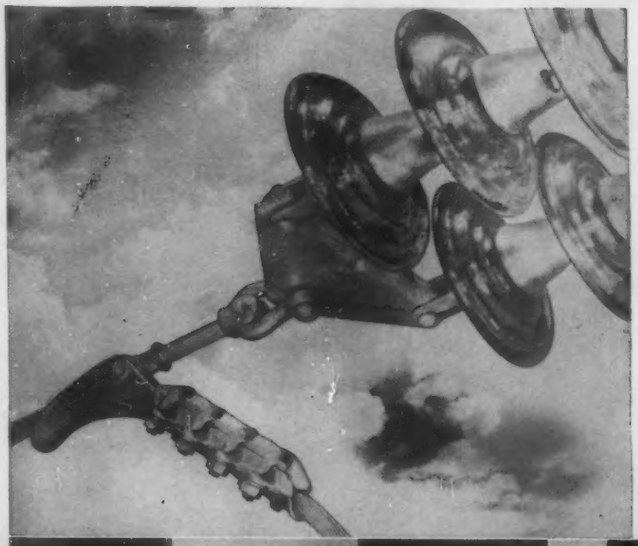
J-40170

WHY WESTINGHOUSE METERS GIVE LONG TIME ACCURACY

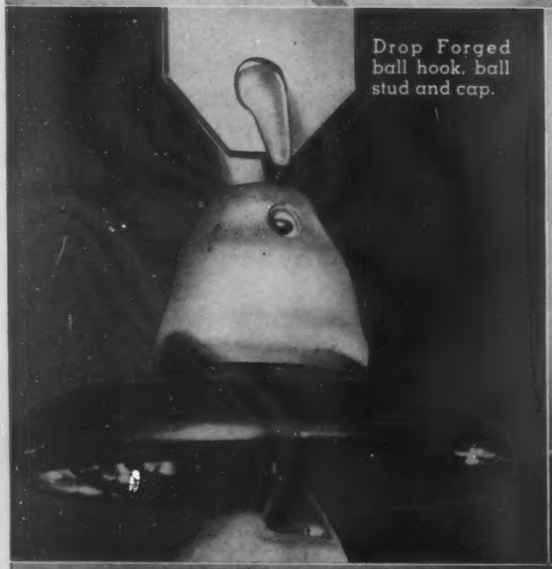
1. *Lifetime Bearings* — anti-friction, no lubrication, no periodic replacement.
2. *Gold Plated Register* — no friction from corrosion to impair accuracy.
3. *One-piece Electromagnet* — fixed performance characteristics.
4. *No Mechanical Adjustments* — no shifting of parts to disturb accuracy.

Westinghouse *Long time* METERS

Hi-Line Hardware Every



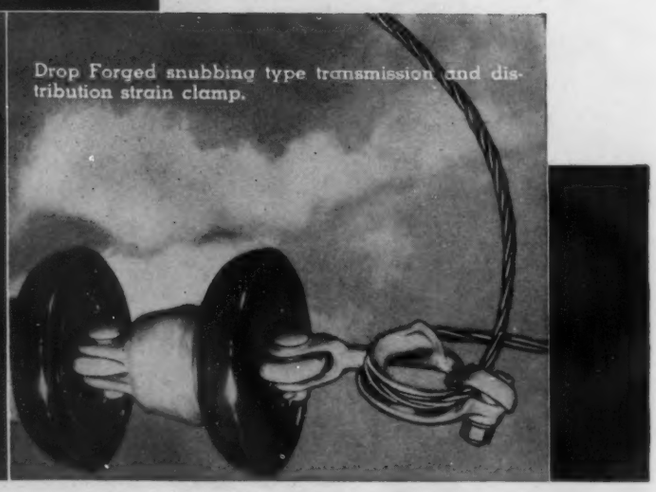
Drop Forged Strain Clamp, double strain yoke set caps and ball studs.



Drop Forged ball hook, ball stud and cap.

Drop Forged heavy duty type suspension clamp.

Drop Forged heavy duty type trunnion clamp.



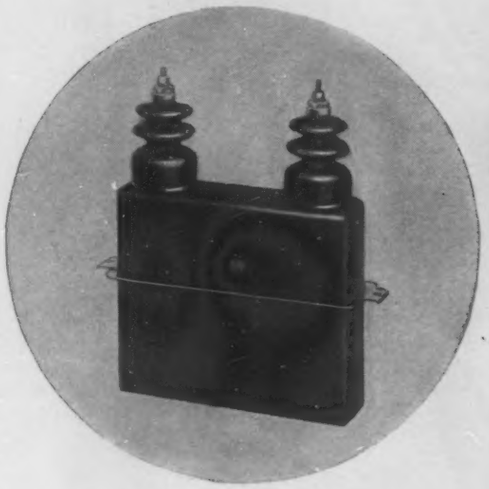
Drop Forged snubbing type transmission and distribution strain clamp.

Engineer Should Keep on File

Classified and as concise as a directory, this catalog was designed for engineers. It is in blue-print form and void of all flowery descriptive matter. A short treatise is included as a foreword for those interested in forging procedure. A reference book every engineer should keep on file. We will send you a copy by return mail.

Address

Advertising Dept.
The Brewer-Titchener Corp.
Cortland, New York



YOU can install Pyranol capacitors on your most vital circuits with absolute confidence.

As a company, we take pride in the quality we build into all of our apparatus—and in the performance it renders our customers. Yet no product we build will give you a finer operating record than these modern, lightweight Pyranol capacitors.

Pyranol has revolutionized the design of capacitors and greatly extended their application. Industrial plants have bought them in increasing numbers for power-factor improvement because they are non-inflammable and nonexplosive. Utility operators particularly appreciate the stable characteristics of Pyranol, which assure long life and dependable operation.

Specify Pyranol capacitors always for your most important circuits. General Electric Company, Schenectady, N. Y.

GENERAL ELECTRIC

360-134

ELECTRICAL WEST
June, 1938
Vol. 80, No. 6

ELECTRA'S HUSBAND

The Wives Talk Conventions

WONDER what wives think of conventions, anyhow?" I must have been thinking out loud, for Electra next day showed up with some of her opinions all written out. These are her ideas entirely—I disclaim any connection with the sentiments at all:

I was talking with a friend of mine about conventions the other day(wrote Electra) and we agreed that on the whole we enjoy them.

"I sat in at one of the business sessions once," she told me "and really I was quite surprised at the serious work that was done."

"I know," I agreed. "I could wish that some of these people who criticize the 'power trust' and think of it as a group of grasping financiers would sit in some time at one of the business building or engineering sessions. They'd get a very different idea. Here are a group of hard working men whose salaries aren't too impressive—"

"Don't I know it?" said she.

"—Too impressive," I went on, "very seriously considering how best their companies can render a better service to the public. They exchange new ideas, bringing methods and designs out in the open for the other man to use. They worry over unsolved problems. They accuse one another of having overlooked some angle of better service."

"In fact," she put in, "they sound sometimes like a combination of Boy Scout and Rotarian, with leanings toward the Salvation Army.

"But the point is," I said, "they are honestly trying to do a better job and to cut costs in every way so that rates can be reduced. I doubt if any other line of business has made so many improvements in its service in so short a time and thereby lowered the cost of its product."

"I know," she agreed. "I have never understood quite why the public has picked on the electrical industry to be the object of its special criticism."

"Probably on the same principle that the man who goes suddenly crazy murders his wife and mother first of all and then sets out to get even with the rest of the world," I told her.

"But conventions aren't all serious and dry," she changed the subject. "Some of them are social and wet—I guess if the wives of convention-attenders really expressed themselves—"

"And don't they!"

"—They might say a word or two on that subject," she finished.

"Well, personally, I'm willing to be open minded on the subject of the contribution which an occasional drink makes toward good will and the development of friendships," said I. "And undoubtedly one of the great things men do get out of conventions is the establishment of friendly relations with others in the same line of work."

"But I've wondered sometimes," she remarked, "if the peculiar uninhibited selves which some men exhibit after too long a session in room 695, or whatever it may be, are really calculated to promote friendships. You learn a lot about people after they've had a few drinks, but you don't always like what you learn."

"Well," I admitted, "I have wondered sometimes whether some men at convention were worth their hotel bill to the employer who sent them there. But I honestly think the number is few."

"Oh, I know I'm queer and old fashioned," she insisted on pursuing the subject, "but I simply can't see the idea that a manufacturer who wants later to sell machinery to the men who are attending a convention should therefore provide them with a place to lounge and free liquid refreshment. The 'entertainment salesman' has always seemed to me to occupy one of the lower and more unlovely levels of business ethics. But this, I know, is a subject my husband would tell me women know nothing about."

"What we do know about is the women at convention," I said, glad to drop the point. "And on the whole they're a particularly nice lot, don't you think?"

"But some of them know mighty little about things electrical," she said. "Well, after all, when the minister said 'I hereby pronounce you—' he didn't thereby make electrical experts of them as well as electrical wives. Though the rest of the public sometimes seem to think so."

"That gives me an idea," said I. "What would happen if there were a serious section of convention activities devoted to the wives of legitimate members of the electrical industry which would run parallel to the men's? There could be a course in the latest developments of kitchen planning, a few principles of lighting in the home, an exhibit of new model equipment and . . ."

"They'd have to cut out a card party or two."

"That wouldn't hurt, they're usually a bit stupid," I countered. "It would be a lot more fun to learn first hand about some of the things we read about in our husband's electrical magazines. Why between the two of us, we could work up a program ourselves. I remember at one convention a man spoke to us about a wife's relationship to her husband's job. Some of the women who heard that talk are still talking about it and that was ten years ago."

"Perhaps next year some one will do a bit of planning for our information."

"Well, we'd have some door prizes," I made it up as I went along. "And we'd exhibit a movie star or have some free recipes to give away—I bet they'd eat it up just as the housewives on the outside do. They'd be glad to have something real to do while their husbands are tied up."

"Perhaps a wife or two might present a paper," my friend said beginning to like the idea. "I'd be glad to talk on 'What my husband doesn't know about electricity in the home.' We'd get some discussion from the floor on that."

"And I'd write a paper on 'Telling Husbands How to Run a Convention,'" I said.

Well, I have—and here it is.

Sell Benefits—Increase Sales; Keep Faith—You Can't Lose

The Industry's Progress and Outlook

By W. C. MAINWARING
President, Northwest Electric Light & Power Assn.

DUE TO the knowledge gained by our industry in recent years we are, or at least should be, in a better position to meet today's problems. Some of the important trends evidenced then are apparent now, and should guide us through. During the period of business re-adjustment that existed through 1931 up to 1936 it was noted that the sharpest falling off in kilowatt-hour sales was in the industrial and commercial fields, while the domestic use remained more stable. Those companies whose earnings were made up of a substantial percentage of domestic sales suffered less than those whose chief business was in industry and commerce. These trends are again noticed, and since most of us in this territory have in the past few years put major effort behind the development of domestic load and built it up to a higher percentage of total, it will perhaps be reasonably accurate to state that we are hurt less in the present depression than during the one previously referred to.

The figures on the increase in domestic consumption in the Northwest territory are indeed interesting. Looking at some of the increases reported by individual companies in ELECTRICAL WEST's statistical issue of last February, we find average residential consumptions increasing in the past three or four years on an average of eight to ten per cent. One company's increase in four years measured 37 per cent, while several recorded a 20 to 25 per cent increase. It is also interesting to note that almost all the major companies in the territory now have average annual residential consumptions of from 1,200 to 1,400 kw.-hr. One has recently reported crossing the 2,000 mark, and two or three others are rapidly approaching this figure.

This fact emphasizes that promotion and selling efforts in the past two years have been effective, and in this connection another trend should be noted. Utility companies over an entire territory have given increasing attention to sales of appliances by dealers other than themselves. Everywhere is this trend apparent with the result that there are now many more dealers aggressively selling electrical appliances than there were, and the old established dealers have become more effective in their sales work. The results from the dealer standpoint have been that, whereas utility sales used to represent more than 50 per cent of the total appliance sales in the company's territory, now this percentage has dropped in many cases to as low as 10 to 20 per cent of the total, and the total volume of sales has increased. This is truly a healthy condition since it multiplies tremendously the number of salesmen in the field and tends to create a growing group of prosperous firms in the electrical business in our community.

It is gratifying also to note the effectiveness of utility promotion in fields other than residential. The same statistical issue of ELECTRICAL WEST shows substantial increases in commercial lighting, commercial cooking, air conditioning, and various heating applications, all tending to a greater use of the numerous services electricity makes possible.

The spread of our service to farms also makes an impressive record. Edison Electric Institute's statistics as of December 31, 1937, to which I have added the 12,400 farm customers of the B. C. Electric Railway Co., show that 132,521 farms are now receiving central station service in the territory of this association. The percentage of farms served to the total number of farms having dwellings valued at $500 or more in the five Northwest states (British Columbia excluded) now stands at the impressive figure of 62 per cent. Even during the past year, when it must be recognized that money for capital expenditure was not too plentiful, a good record was made in extending lines to new farms. Some of the companies in our territory increased the number of their farm customers over the previous year by percentages as high as 16 or 17 with the average increase indicated at about eight to ten per cent. The fact that very few R.E.A. projects have been initiated in the Northwest is indicative of the extent to which the area is now, and for some time has been, served, since there are apparently few localities where conditions for R.E.A. loans as to number of customers per mile of line can readily be met.

These are just some of the high lights of the past year's operations of the utility industry in our territory that appeal to me as being significant. Although we cannot point to a highly successful year from the standpoint of net earnings, we can indeed be proud of our record in making more and more service available to an ever increasing public, with the consequent benefits of comfort, convenience, and, in a multitude of cases, actual financial benefit to that public.

A factor that should never be overlooked in any consideration of the increase in use of our service is that as this use increases, the unit cost to the customer goes down. This has been brought about in part by rate decreases and in part by the automatic operation of our promotional type of rates which put a premium on extensive use. The January 1938 report of the Public Utilities Commissioner of Oregon shows that this constantly falling curve of revenue per kw.-hr. for residential service has reached 2.78c. This figure for the state of Washington as reported in the statistics of the Washington State Department of Public Service was, at December 31, 1937, 2.51c. The comparative figure for British Columbia is 2.78c, the same as Oregon, and other areas in the association territory have comparable records. Although these

figures are generally known to most of us, I am purposely repeating them because I am firmly convinced we should take advantage of every opportunity in our personal contacts with our public to brag a little about what our industry has done in this respect.

I cite these few high spots indicating industry accomplishment in our territory because whether or not we are able to show improvement in our financial statements to our stockholders, I still believe that these accomplishments indicate we are following in the true course. If we still continue vigorously to promote our business with the public interest in mind, as the foregoing record indicates we are, then financial success for our companies will automatically and eventually follow.

More and more in recent years has this idea of selling our service to our public, rather than merely distributing electrical energy in the form of kilowatt-hours, been kept uppermost in the minds of utility managements in this territory. For some time now the idea has never been allowed to lapse in our minds, and we see it cropping up frequently in the discussions taking place in our various association meetings.

Let me repeat, if all of us continue to think of the product we have for sale in the terms of what it would do for our customers by way of bringing comfort and convenience, or saving operating costs in the customer's business or farm, and generally what the *use* of our service can bring him in the form of benefits, then many of the problems of our industry, largely forced on us from the outside, will eventually evaporate into thin air and be with us no more. And further, the financial statements we will be able to show to our stockholders when more nearly normal business conditions return will be of a type that will invite their continued confidence in us.

I do not forget the third great element in our business—that army of workers in our organizations who represent the front line troops in all our progress. It scarcely needs to be pointed out that the course advocated in the foregoing, which is the best for the public and which will prove the best for the stockholders, is likewise the best for the employees. It is the course that will engender pride in ones' work without which material compensation, however great, is hollow indeed. But beyond that it is the course that necessarily will yield the greatest possible material compensation. Take pride in your industry; keep your faith in it, and in its leaders. Follow the true course toward the objectives of your company and the industry you have cast your lot with will not let you down.

To Reach Its Ultimate Goal The Industry Needs Support

United Action Will Overcome All Troubles

By R. M. ALVORD

President, Pacific Coast Electrical Assn.

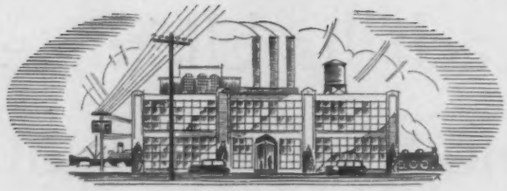
EACH individual business organization within the industry, be it a contracting firm, a manufacturer, a utility, or any other unit of business, finds that its operations must be reviewed and ever changed efficiently to meet the every day problems of its doing business. It is the function of the management of each individual firm, acting in cooperation with its employees, to meet its firm's problems as they arise, when these problems concern the individual organization only. There are many matters, however, that are common to all firms doing a certain kind of business, such as the problems that confront all jobbers, all dealers, or all of the utilities. The best way to analyze and to meet such common conditions is by the united efforts of all those engaged in the particular kind of business involved.

We find, however, that there are many opportunities, as well as many problems, that are common to all units of the electrical industry, and which affect the well-being of all units mutually. These matters can best be acted upon by an all-industry-organization, and such is the function of the P.C.E.A.

Our association is organized on an all-industry democratic basis for the purpose of cooperatively improving service to our customers, the public. It provides a team in which every company and every individual associated with our industry may take part. Our industry has a record of achievement in more electrical service for more people at less cost, of which we are justly proud, and much of it has been the result of team work. We are confident that as we go forward with our work in the interest of better and better service to the public, we will find that our customers will respond with increased goodwill and a cheerful readiness to pay adequately for that service. Let us continue to build on the foundation of that sound philosophy—"He profits most who serves best."

A year ago, Mr. Fred Lewis, in his president's address to this association, expressed a kindred thought regarding the purpose of this Association when he said, "The work of our Association is dedicated to better public service to be brought about by a more thorough knowledge of our own business followed by the interpretation of that knowledge to the benefit of the consumer." Others have indicated that customers seldom fully appreciate the benefits of electrical service because they do not fully understand it. On the other hand, we know that knowledge and understanding usually bring friendliness to any worthwhile activity. Therefore, this is one of our problems.

One of the revelations growing out of recent social and political changes has been that American business and industry need friends as well as customers. Our electrical industry is no exception. Every firm, every unit, every



branch of the business faces this problem. In our thousands of men and women workers, we have a tremendous latent asset for winning this friendship. As anxious and willing as these people might be to do their part in winning public confidence and respect for the industry, they are handicapped through lack of information. How can we expect them to defend our industry against mis-statement and misrepresentation if they are not armed with facts which they can understand and use?

These facts and the expressed desire of many of our industry associates for more knowledge about our great industry prompted the formation of a Committee on Industry Information. Its job is to develop a plan for the collection and distribution of useful information to those of us who wish it.

The question might be raised as to what kind of factual information could be used and where it could be secured. The files of every organization are full of it. The problem is one of selection and interpretation. One forceful example comes to mind. In a recent issue of "The Altantic Monthly," Gerard Swope commented on the American standard of living as compared to the European standard. He used the hours a workman must toil to pay for the various needs and comforts of living as a basis for comparison. In America the average workman would toil 3.6 minutes for the purchase of a kilowatt hour of electric energy. In the nearest European country, the time was 12 minutes. In one country it was 43 minutes.

Mr. Swope said in this connection, "In this country, generally, the development and distribution of electric energy has been in private hands, and the problem of making it available to more and more millions of homes has been given constant study, so that now over 22,000,000 homes are electrically connected. The increase in use and the resulting conveniences are apparent on every hand."

He offered similar proof on certain accepted electrical conveniences. To purchase an incandescent lamp, the American worker would toil 0.2 hour. In the nearest European country he would work 1.2 hours, or six times as long. For an electric refrigerator the figures were one month of labor in America as against 2.4 months minimum and 7.3 months maximum in European countries.

This is but one example of the vast stores of factual information which could be used by our people in winning friends for our industry.

Another need of our industry today is a high order of salesmanship. Under the American system, ours is a highly competitive market in which the industry with the best salesmen wins the major share of the customer's dollar. This competition is increasing and if we are to hold our position in the marketplace, we must improve our sales technique. This means training of our existing sales organization and the development of a constant source of trained recruits to fill the ranks depleted by normal turnover. There are relatively few individual units in our industry large enough to provide such sales training for its own organization. Our Committee on Sales Training is making a thorough study of this problem. It is our hope that a practical plan will be developed whereby this need will be supplied through cooperative effort.

Another selling need is that cooperative promotional programs be more uniformly supported by the individual units of our industry. It is recognized that actual selling can best be done by the individual company, but general promotional work to form a foundation for individual selling will usually be more effective and efficient when operated on a cooperative basis.

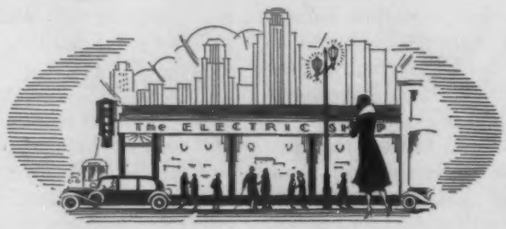
The Better-Light-Better-Sight campaign provides ample evidence of the value of such coordinated effort. Years of work and many times the same amount of money, if put forth by the same companies individually, would undoubtedly have been required to produce results equivalent to those of this very successful cooperative activity.

In an industry as vital, as progressive, and at the same time as complex in its makeup as ours is, we have plenty of mutual problems and an equally great number of mutual opportunities. Many of the problems have been discussed and solved at our conclave and committee meetings during the last year; on others there was no agreement of minds, and undoubtedly there are many other problems which have yet to come before our discussion groups. The conduct of these discussion groups at the conclaves, demonstrates the truly democratic character of our organization—a voluntary and mutually cooperative assembly for concerted action in the attack on problems affecting our industry.

However, to achieve fully our desirable goal we need the wholehearted support and participation of every individual in the electrical industry. To accomplish that, we must broaden the base of our association work so as to assume a self-interest motive for every unit and every individual in the industry to align himself with our activities. We need to take up more problems that are of interest to the contractor, the dealer, and the wholesaler. Without such self-interest, no cooperative undertaking can succeed. As an ideal we should aim for a coordinated organization which is truly representative of the industry and all its branches in their relationship to each other and with the public, jointly, but such an ideal can not be achieved over night. We have no dictator or supreme arbitrator in our industry and don't want one.

Under our democracy we are banded together to do for ourselves jointly those things which we cannot do for ourselves as individuals. We accept this method with full knowledge that progress will be slow; however, we know that it will be sound, because it will be based upon unified opinions that grow out of open and free discussions.

Because there are temporary disagreements, we should not become discouraged. Democratic discussions will promote understanding and eventually bring about progress.



Business Needs More Customers & Friends

By DON FRANCISCO
Executive Vice-President
Lord & Thomas, Los Angeles

BUSINESS needs more friends, as well as more customers. There is deep-rooted resentment against bigness, authority, power, profits. Never has individual or corporate success been given less applause. The spirit of the times seems to be to tax the thrifty, soak the successful and eliminate the efficient. There are crusades to re-distribute wealth, to break up concentrations of power, to do a hundred other things.

Economic advantage is confused with illegal advantage. Businesses that are large are accused of being monopolies. Businesses that can sell for less are denounced as unfair. Throughout the world the masses are in a critical mood —and they have their eyes on industry.

Politicians are brokers of ideas. They are dealers in the legislative process. They handle what they think the voters want. At the moment they think the voters want laws and taxes to soak business.

So we have legislation by pressure groups. A well organized, militant minority, if sufficiently vocal, can convince legislators that it represents public opinion—or at least a lot of votes. Thus one group can use the law to handicap its competitors.

Much of the legislation passed in the crusade to "soak business" really "soaks the consumer." But the average citizen is ignorant of that fact and little effort has been made to tell him. Consumers are not organized, although they should be the largest and most influential group of all. The American philosophy of maintaining free competition, encouraging individual initiative, rewarding efficiency and improved methods if they better serve the American citizen, seems to be giving way to a policy of penalizing successful business to make the way easier for less successful competitors.

Today, a business that develops a method of distribution that enables it to reduce prices is likely to be confronted with a law to remove that economic advantage. We have laws to maintain prices, laws to raise prices by making foods scarce, taxes to raise the prices of merchants that sell for less. Right or wrong, these measures tend to subsidize inefficiency and raise prices. The point is that these facts are unknown to the average voter who is most vitally affected.

Politics and industry are in competition for the public's favor and industry is suffering because it has not told its story. Business is looked upon as a selfish master—not a good servant. No amount of lobbying at the State and National capitols will correct this public attitude. A successful business has won the consumer, so that it may thereby win the dealer, so it must now win the voter in order to win the politician.

Business cannot proceed on the assumption that customers are friends. Motorists may buy at your service station but damn you because they think you are a monopoly. They may go out of their way to save a few pennies at your chain store and then denounce you for paying low wages. Making friends and making customers are two different jobs—separate though related.

Big business has generally done a good job of selling its accomplishments to its stockholders and the investing public. Probably it has done too good a job of publicizing the kind of things that its top executives like to read.

The public knows that businesses are big, spend large sums of money and make big profits. Annual reports to stockholders, earning statements and the financial pages of our newspapers take care of that.

But have you heard of annual reports to interpret a company's progress to its employees? Or when large expenditures are announced to the public are they often in terms of the number of new jobs created?

In the last analysis, people are most interested in what affects them. When the average citizen votes, he consciously or unconsciously votes for himself. He has little interest in the problems of the utilities, railroads, banks or chain stores. What he wants to know about proposed laws and taxes is how they affect him.

That is both the opportunity and safeguard of business.

Taxes on business arouse the interest of the average citizen when he is made to understand how they increase his own expenses. The working man becomes concerned with a specific piece of legislation when he learns that it may affect his job.

The average American does not know what industry has done for him—to create jobs, to effect economies, to improve products, to perfect service, to save time and money, to reduce the cost of living, to raise thereby the standard of living.

Business has a big job of education and interpretation to do. It can protect itself by first demonstrating and telling how it serves America. Then, when necessary, it can show how unfair legislation handicaps its ability to render that service.

Business needs friends — intelligent, sympathetic friends—friends that understand how it serves, can defend it from their own selfish viewpoint, can be an army of recommenders.

Without friends, without favorable public opinion, a business with a million customers can be crucified by a militant minority.

Thus public relations has come to be of prime importance. Public relations is neither press agentry nor institutional advertising. It is not sending out press releases after the show is produced. It starts while the show is being planned. It starts with an effort to mold or modify events in order to create favorable news and make friends. It starts on the inside with a realization that the best private relations make the best public relations. Just as the advertising man strives to get his product and package right before he shouts about it, so the public relations man starts by seeking the deep-rooted weaknesses of a business and correcting them. And finally he realizes that it is not enough for policies to be right—they must also seem right. The real public relations men are the top executives who make policies.

Businesses make friends in the same way that people do and one of the first rules is that to have friends you must be one.

Four Case Histories in Making Friends

MANY and varied are the methods used in making friends for such an impersonal thing as a corporation. Advertising plays an important function. A particularly successful advertising campaign is one currently running in Portland newspapers over the signature of the Northwestern Electric Co. Although the primary purpose of this campaign was to sell more electricity to more people, a secondary function was to personalize the Northwestern organization in the minds of its customers. This was done by creating a realization among present and prospective customers that numerous friends and neighbors were part of the utility organization.

Theme of the series was the company's "400"—comprising 499 men and women who took pride in supplying a high order of electric service. Examples of extra-curricular or unique services were selected from the many such experiences reported by employees. These were dramatized in highly effective copy. Result is that the public has been impressed favorably and distinctly that Northwestern Electric Co. is composed of men and women who are an integral part of the community and that the company is not just a corporate creature of copper, stone and steel. The campaign was produced by McCann-Erickson, Inc.

INDUSTRIAL motion pictures are used extensively in the work of making friends. Novel applications of talking motion pictures have been developed. Here is one aimed at the "kids."

"C'mon fellers,—what a day for flying! Ain't the wind great?" And shortly a group of future business men and voters have their kites flying in the wind—and into the electric wires.

Now "a kite in the wires" does not build good will either for the boy who lost it or for the public service company which operates the lines, or for the thousands of customers whose electric service may be interrupted thereby.

Every spring and fall Young America puts thousands of kites into the air —and all is well until some hundreds of these kites, with wire in the strings or tails, drift into high tension lines. Then trouble comes. In the spring of 1937, Portland General Electric Co. suffered, as a direct result of "a kite in the wires," seven severe service interruptions which inconvenienced thousands of customers and cost the company several thousand dollars. The previous year a boy flew a kite with tinsel string into a 57-kv. line. The boy suffered severe burns, a neighbor who went to his assistance lost his life, and service to thousands of customers was interrupted,—another costly experience.

These incidents caused officials of the Portland company to give thought to reducing such annual losses. This company had experimented with a relatively new medium of publicity and good will building,—the sound movie. Sensing the fact that the public is "movie minded," and that impressions received simultaneously through the eyes and ears are far more effective and permanent, President Franklin T. Griffith determined to experiment with the sound movie.

The first attempt in talking pictures was a twenty-two minute, 794 foot, 16 mm film, entitled "Oregon." This picture was a narrative film depicting the scenic, recreational, industrial and residential advantages of Oregon. The part played by the Portland General Electric Co. in the industrial growth of Oregon was indicated in a very inoffensive manner. This film was shown to over 200,000 persons—our patrons. The public acceptance of the film suggested an approach to several utility problems, one of which was "a kite in the wires."

Unable to obtain from regular film libraries movies suitable to the company's several needs, President Griffith decided to make his own. His organization was scrutinized for technical talent. The company boasted one of the finest sound engineers in the Northwest. It had several amateur cinematographers. So work started. No attempt was made to compete with Hollywood productions, but good cameras, sound recording and film editing equipment was obtained. Produced was the first synchronous sound-movie in dialogue, and it was sufficiently good to serve our purpose. That purpose was to educate youngsters visually to the danger of flying kites close to electric wires. Anticipated results were: saving lives, reducing damage claims, reducing service interruptions and, equally important, building good will of parents, teachers, students and the general public by virtue of the utility's sincere interest in the welfare of children and customers.

Company employees produced and filmed the entire picture. This included writing the scenario and continuity, selecting and training the several actors (all employees and children of employees), building special effects such as miniatures of a high tension line "burn-down," photographing, recording synchronous sound dialogue, cutting, editing and "sincing" the sound and action films so composites could be made in regular laboratories.

Two examples from an advertising campaign of Northwestern Electric Co. which is making friends for that utility in the territory it serves

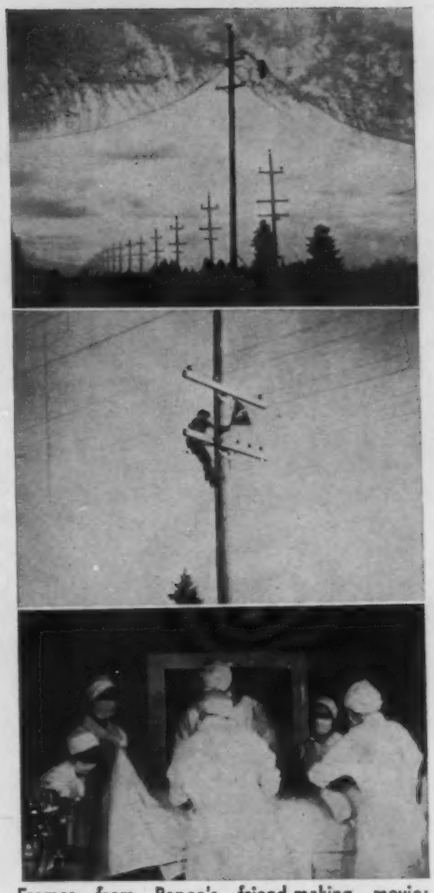
The Portland School Board heard what was being done and requested a preview of the "Kites" film. This school board has always been very cautious, and properly so, before permitting any industrial films to be shown in the public schools. After previewing the picture "Kites," the school board unanimously approved it, and authorized its showing to 40,000 Portland school students. Public, private and parochial schools in outlying cities and districts have requested its showing. It already has been shown to 10,000 children and only a start has been made.

A CERTIFICATE of inspection approving a wiring installation—few people would imagine that it had a good will value. But A. L. Stone, electrical contractor of Los Angeles has turned it into one. He has thereby endowed it with a pride of workmanship which gives the customer a like feeling of pride in the job.

For several years Stone Electric Supply Co., of Los Angeles, has reflected the meticulous care in workmanship that A. L. Stone brought with him into electrical contracting from the telephone business. How to get over to the customer a respect for that clean cut workmanship and a quality job was the problem. Unless some idea was employed that would bring this pride in the job to the attention of the customer, it was very apt to go unnoticed. One day Al Stone thought of a nice way to do it subtly. He had a photostat made of the final approval certificate of inspection, framed it, and placed it near the switchboard. Now he makes this a regular practice. That tag of approval acts as a sort of guarantee of performance. It also reminds the owner whom to call should he want further electrical work done.

THE face that a public utility turns to its public determines the response of the public to its expression. A friendly, human, good humored face attracts friends. A reserved, dignified one may inspire respect but it does not invite friendship. Too often the executives of large corporations feel the seriousness of their responsibilities so deeply that it builds in them a dignity and reserve hard even for their intimate associates to bridge. And such a reserve and dignity may reflect itself throughout the organization and particularly in its public face—its advertising.

One company that has been eminently successful in breaking down that cold reserve, that aloofness which characterizes many corporations, is the San Diego Consolidated Gas & Electric Co. And by breaking away from that calm reserve and dignity, it has established



Frames from Pepco's friend-making movie: Top—a kite causes a "burn-down". Center—a trouble call for a lineman. Bottom—an operation may be interrupted

a warmer and closer friendliness with its public. Fundamentally this is because its executives themselves are "old timers" whose youthful unsureness no longer demands dignity as a prop for responsibility. They are friendly and can well afford to let their works bespeak their adequacy for the job assigned to them. Thus they are willing to allow the advertising done by the company, both over its own signature and for the cooperative business building organization of the industry, the Bureau of Radio and Electric Appliances of San Diego County, to be good humored, human, friendly.

While all of its advertising and publicity has played a part in this friendly and cheerful relationship with the public, in the field of radio this utility has been particularly creative and effective. True, the consistent use of radio programs, on a regular year 'round basis, has been one factor. Yet it is the type of program, and more particularly the common denominator they seek to reach among the mass of listeners, that directs them closer to the average of customers' tastes and thus brings them success.

Forrest Raymond, advertising superintendent, has used dramatized serials or series programs as the main radio feature sponsored by the company. Among these were a series dramatizing the life of Thomas A. Edison, and so successful were they that the series was later syndicated and is still being used in other regions of the country on recordings by other sponsors in other lines of business.

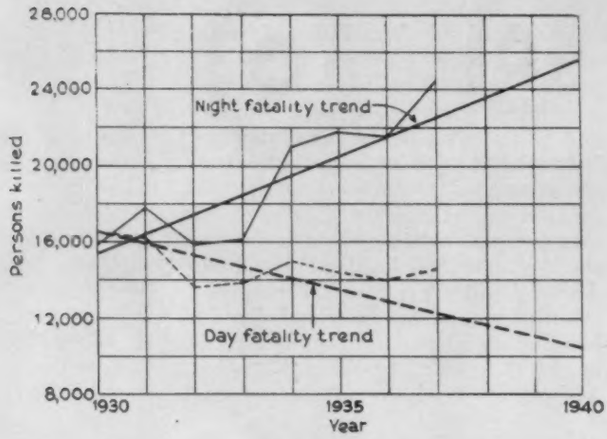
In football season, a radio series on this popular sport is usually run, with prizes and contests that require a visit to an electrical dealer's store to obtain entry blanks. Dealers are tied in virtually with all programs, and to give publicity to the frequent and very popular shows, expositions, institutes and what not, that the Bureau of Radio and Electrical Appliances are constantly conducting.

Recently this company used the "Phenomenon" series of radio transcriptions in which electrical progress was dramatized. Except for a short commercial mention of the company as sponsor and one mention of its low rates, the main commercial announcement was dedicated to advertising San Diego and its commercial, residential, cultural, and scenic attractions to outsiders. This gesture on the part of the company was a contribution to local pride and local publicity and made a favorable impression on civic organizations and officials.

When its newest turbo-generator was started at the company's Station B, a civic event was made of the occasion, with the mayors of all the towns in its territory and other public officials as guests. A radio skit preceded the dedication ceremonies, and into it was put much of the history of the city and county, the starting of the electric company, and finally a scene dramatizing a meeting of the board of directors in which was debated whether to invest the large sum needed to add a new generator. Thus the radio public was acquainted with some of the economic factors involved and given a better and more human appreciation of the company as a group of human beings rather than a cold impersonal corporation.

Radio is an electrical medium for reaching the public. In using it consistently and persistently the San Diego Consolidated Gas & Electric Co. seems to have pitched its appeal just at the level where most people live. It uses good humor, civic boastfulness of the usual local town variety and which luncheon clubs indulge in; it makes a historic and a romantic appeal, it plays on the heart strings, it is just as human and "garden variety" as other citizens, and therefore it has more friends who swear by "the gas company" in time of need. After all, dignity and reserve do not beget such appreciation, no matter what respect they may command.

LIGHT vs. Death



As the trend of daylight accidents decreases, that of night accidents shows an alarming increase. These curves were made from data compiled by the Travelers Insurance Co.

SINCE its birth in 1776 the United States has engaged in six wars extending over a total period of 15 years. In those wars 244,357 soldiers were killed in action or died of wounds. In the 15 years since 1923 a total of 441,912 people have been killed in automobile accidents on our streets and highways. In 1937 this traffic slaughter reached new peaks—40,300 killed and 1,221,090 maimed and injured. Fatalities have increased from 18,031 to the present staggering total. Insurance statistics indicate that one out of every seven children born this year will be the victim some day of a serious or fatal highway accident unless the present ratio of highway accidents to population is reduced.

Last year 61.2 per cent of these motor vehicle fatalities occurred between the hours of 6 p.m. and 6 a.m. when less than 25 per cent of the motor vehicle miles are traveled. The ratio of night to daytime accidents is increasing. These figures are both a challenge and an opportunity for the electrical industry. Darkness—that is, lack of visibility—is the only important difference between driving in the daytime and driving at night. The problem is one of perfecting a properly integrated and practicable program of highway lighting.

The California State Highway Commission has evolved its own technique and equipment for installing highway lighting. Here is some of the equipment placing conductor on the Waldo approach.

Many are the agencies which are today concerning themselves with this problem of traffic hazards. The variety of remedies proposed covers a wide range. Recently a study of all these programs has been made and certain safeguards common to a majority compiled into one platform. Here are the seven points it covers:

1. A progressive policy with respect to highway construction and improvement involving such items as widening or dividing main highways; easing and banking of curves; construction of overpasses and underpasses and building highway sidewalks and guard rails.
2. Uniform and attention-compelling traffic signals and road signs.
3. Safety lighting of night accident zones—heavily traveled and hazardous sections of highways.
4. Vigilant patrols and enforcement of uniform laws for the motorist's protection.
5. Mechanically safe cars periodically inspected.
6. Continuous education of both new and experienced drivers; also pedestrian education.
7. Discouraging the diversion of gasoline tax road funds for any other purpose than highway uses.

Obviously the electrical industry's principal concern is with the third item on this program. However, there are many factors which must be considered if a constructive approach is to be made toward a solution.

In the first place the automobile headlight will have to carry the burden of night illumination on perhaps 90 per cent of the nation's highways for which any other form of illumination is economically unfeasible. The ordinary automobile headlight has been steadily improved and when properly installed and maintained it performs the function for which it was designed. Despite its efficiency, the headlamp has certain limitations. Brighter lights to produce greater visibility would augment one of the causes for night accidents — glaring headlights which temporarily blind drivers of approaching cars. Furthermore at today's car speeds the night motorist outdrives his headlights, i.e., his maximum visibility in case of emergency is not sufficient to permit stopping. Present day headlights enable seeing an object approximately 150 ft. ahead. Including the time required to recognize the danger and the resulting mental reaction, plus the time for actual application of the brakes and that involved in stopping, a car in the hands of a normal driver would require 188 ft. to stop if the speed was 30 miles per hour. At 40 miles per hour the distance would be 276 ft. and at 50 miles an hour, 389 ft. On heavily traveled hazardous roads, some supplementary form of illumination is essential.

Modern safety lighting involves the application of sufficient light from above to provide contrast between the road surface and a vehicle, pedestrian or fixed object on the road. Experience has shown that where this type of lighting has been applied the accident ratio has been reduced from 40 to 50 per cent or to a point approximating daylight conditions. The present theory is to provide for the illumination of night accident zones. These are defined as highway sections where traffic density is high and night accidents are most frequent. Such a zone might consist of a single mile of highway or several miles or it might be simply an intersection, crossing, underpass, dangerous curve or a hill. With the exception of certain sections of illuminated highway

California Highway Commission Lights Bayshore

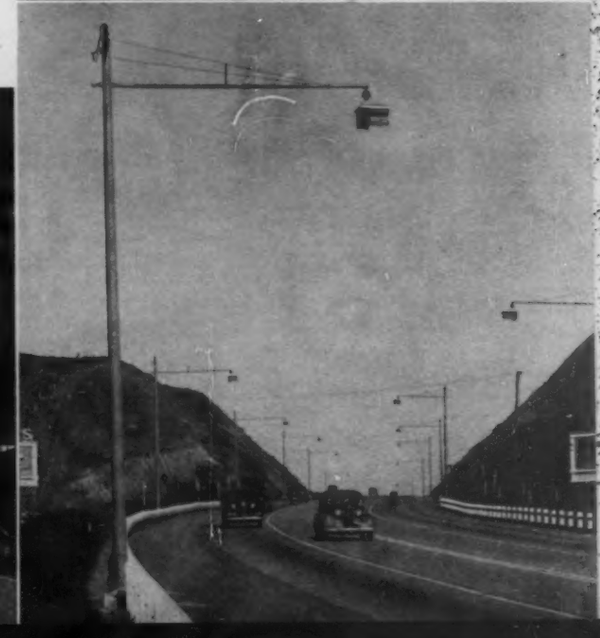
HIGHWAY lighting experiments as an accident prevention measure have been undertaken by the California State Division of Highways. Latest section to be lighted is 3½ miles of the Bayshore Highway (Route U. S. 101) south of San Francisco which had an accident record sufficiently serious to warrant illumination. The installation consists of 139 units which are staggered on an average spacing of 133 ft. Mounting height is 25 ft. to the light center.

Illumination is provided by 10,000-lumen sodium vapor lamps. Three different types of units are used: Westinghouse butterfly vertical, Westinghouse pendant vertical and General Electric pendant horizontal. Posts are of two different types—tapered steel 30 ft. high and concrete. Mast arms are steel 12 to 16 ft. long and so mounted as to place the light source 2 to 4 ft. over the driving path.

The installation was designed, purchased, installed and will be operated by the State Highway Division. On the basis of 37.6 units per mile, the cost was $8,200 per mile. The total operating expense is estimated at $54 per unit per year.

A 6.6-amp. series system is used without series transformers. Conductor is No. 6 bare copper. The units are rated at 190 watts and the power factor is 94 per cent. Wire losses are estimated at 10 per cent. The installation consists of two circuits of approximately equal length which are supplied from a point near the center. Energy is furnished by the Pacific Gas and Electric Co. through two 15-kw. 2,300-volt single phase regulators. Operation is controlled by a time switch with an astronomical dial. The energy is sold on a flat rate basis per lamp per month.

Pictured at the right are the three types of units used. At the top is the Westinghouse pendant unit; next, the Westinghouse butterfly unit and at the bottom the conventional General Electric unit. The concrete poles retain their natural finish; the steel poles are painted with aluminum paint. Above is a night view of a curved section on one of the several grades. The white line dividing the highway into lanes is visible for a distance of 1,350 ft. Below is the section leaving the San Francisco city limits. Here the units are mounted on existing wood structures. All photos, as well as the two on the next page, are by Gabriel Moulin.



which serve as testing laboratories, most of the lighting installations to date have been on such hazardous portions of road. Here in the West there have been several such installations, including the two bridges on San Francisco Bay, a section of the road between Seattle and Tacoma, several hazardous pieces of road and intersections in Southern California and stretches in Arizona and Utah. Two of the latest installations are shown in the accompanying illustrations.

Evidence is being collected covering lighted sections of highway in all sections of the United States to show that highway lighting is effective in reducing accidents. The value is also demonstrated by data showing accident ratios on such sections as the bridges across San Francisco Bay which were illuminated from the time of their opening. On the San Francisco-Oakland Bay Bridge the night accident ratio for 16 months of operation has been 0.80 per million vehicle miles. On the lighted section of Golden Gate Bridge the ratio has been 0.90 per million vehicle miles. On comparable sections of unlighted highway with approximately the same traffic density and similar length, the night accident ratio has ranged from 2.45 to 3.20 per million vehicle miles.

It is estimated that there are 50,000 miles of highway in the United States where the night fatality hazard is ten times that of day. This is about 15 per cent of the total mileage of state and federal highways. Yet three-fourths of the night accidents occur on this mileage. The return to the public on the investment for lighting this hazardous mileage is inestimable in terms of dollars. Authorities have said that it would save 5,000 lives, prevent at least 10,000 personal injuries and eliminate 100,000 cases of property damage annually.

To bring this about will require cooperation between many agencies. The electrical industry must cooperate with safety organizations and highway engineering departments. Concrete facts rather than generalities must be brought to the attention of the public. As the public appreciates the value and benefits which will come from adequately lighted danger zones, it will demand highway lighting. Public officials will then respond by installing it. As the number of installations grows, so will popular appreciation and popular demand.

POPULAR demand plus a high night accident ratio led to the lighting of the Waldo approach to the Golden Gate Bridge. A normal hazard of nightly fogs was complicated by the highly lighted bridge structure and the illuminated Waldo tunnel. Drivers emerging from either the bridge or the tunnel were often confronted by dense fog which was likely to tend to accidents. This section consists of a relatively heavy grade on which heavy trucks dropped to very low speeds. In fog at night these constituted a serious traffic menace. In lighting this 1½-mile piece of highway standards were placed at staggered locations 125 and 150 ft. apart between the bridge and the tunnel and 200 ft. apart north of the tunnel. G. E. 10,000-lumen units were used for the installation. Like the Bayshore installation, this was designed and installed by the San Francisco District of the State Highway Commission. The operation of the systems is similar.

What Price $16.00

Economics of Wiring Design and the National Electric Code

By L. W. GOING
Chief Electrical Inspector, Portland, Ore.*

THE widespread claim that the National Electrical Code is responsible for high wiring costs and the repeated criticism of its provisions by certain utility executives has created a major industry problem, the final and correct solution of which can be attained only through the sympathetic cooperation of all branches of the electrical industry, the insurance interests and governmental inspection authorities.

As there is no possible way to determine with exactness what constitutes a reasonable factor of safety in wiring and no way to warn us when the lower limit of safety has been reached it is obvious that there can be no finality to the present standards upon which the Code is based. Because of this difficulty, the conservative members of the Electrical Committee, National Fire Protection Assn. have endeavored to restrict Code development along orthodox lines—they believe (and not without some justification) that increased economy, safety and dependability in wiring installations will result through standardization of devices, materials and methods with opportunity for mass production and installation. They question seriously whether the old and well established methods and materials are in fact burdensome to the industry and to the current consuming public.

On the other hand the liberal members in the Electrical Committee contend that we must introduce new methods and materials if the cost of wiring is to be reduced and we are to secure a greater measure of adequacy in the number of outlets installed and an increase in the numbers of kilowatt hours consumed. While this is a most commendable objective on their part, the difficulty comes in trying to decide just how far existing standards and practices can be lowered without seriously reducing our factor of safety.

Factor of Safety Essential

It may be appropriate here to inquire just what is meant by "factor of safety" and why such a factor is necessary. Obviously almost any type of wiring method may be considered as reasonably safe, if kept under constant surveillance to see that it is not subjected to mechanical disturbance nor injury, and is free from overloads, short circuits, and tampering with the over-current protection. It is because wiring installations are *not* maintained under such ideal conditions—because, in fact, *they are invariably and without exception subjected to such abuse and tampering by persons unfamiliar with the hazards involved*, that a safety factor is essential.

This factor of safety, then, is not so much a measure of the capability of a given wiring method to function safely under normal conditions—it is rather a measure of its capability to function safely under *abnormal* conditions when some irresponsible person places a penny behind a fuse or otherwise bridges the circuit protective device.

The greater the life or property risk, the greater the need for a fool-proof wiring method which will continue to function safely under all possible conditions of use and abuse. Tampering with fuses by persons ignorant of the hazard involved should not be permitted to jeopardize the lives and property of those who may be the innocent victims of such act.

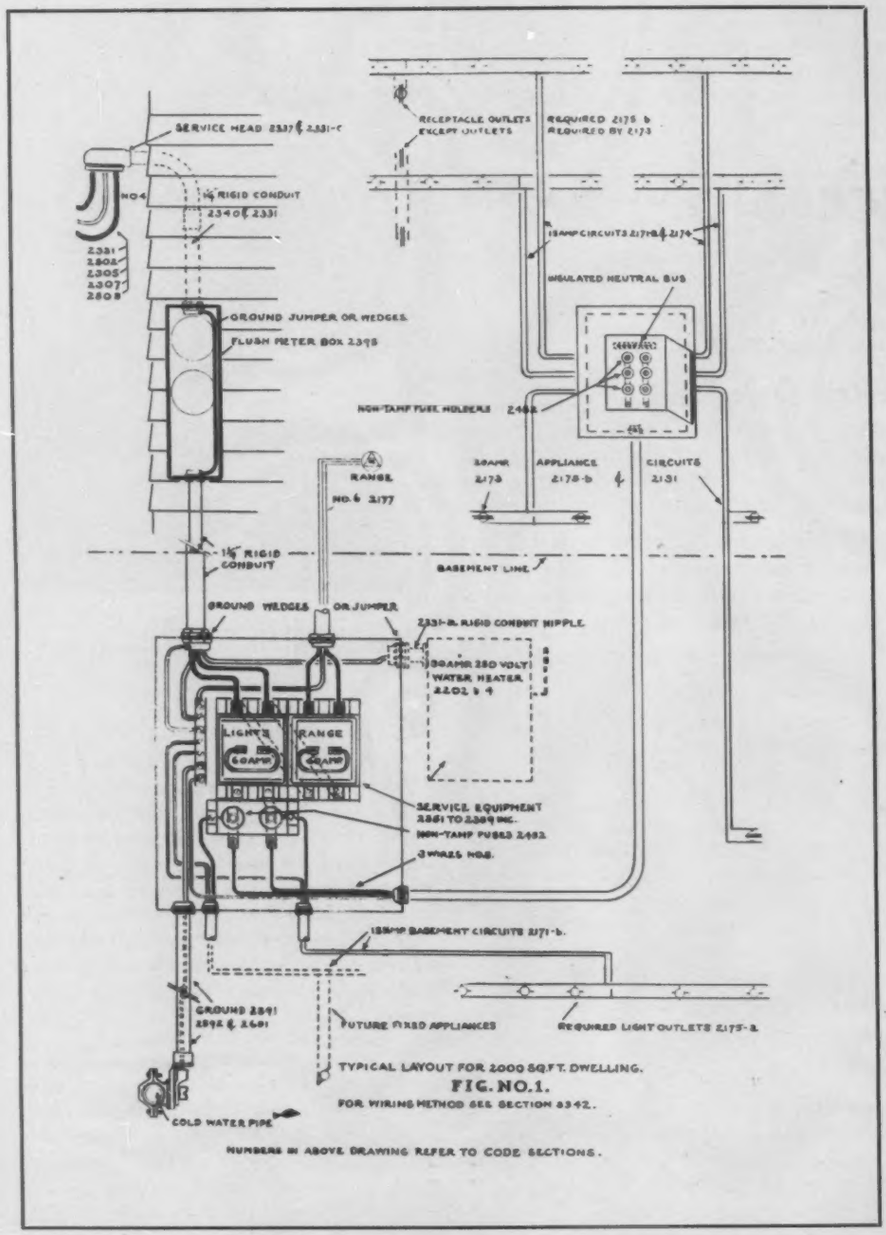
Choice of Wiring Methods

Broadly speaking, local restrictions as to choice of wiring methods originate for two reasons: *(1) The desire of code administrators to maintain in their respective communities such standards of electrical construction as will lessen their responsibilities for fires and accidents from electrical causes and (2) The desire for simplification and standardization of wiring materials and methods which can be attained only through recognition of such methods and materials as have demonstrated their worth through sound experience and the use of which will be least hampered by conditions of exposure or building occupancy.*

Although no wiring type or method can assure complete freedom from hazard, yet it is true that the metal raceway systems do assure the most effective available protection against abnormal electrical conditions resulting from short circuits, fuse tamperings, etc., and that they do provide a ready and economical means for renewing or rearranging circuits with minimum damage to the building structure.

Re-inspection of old wiring has taught us, too, a great deal about the capability of the various types of wiring to withstand use and abuse over a period of years. The rapid obsolescence and costly maintenance of open wiring should, for no other reason than economy alone, eliminate it from consideration as a permanent wiring method in the great majority of buildings. On the other hand metal enclosed wiring systems in service over a long period of years have (except in corrosive atmosphere) shown a wonderful freedom from maintenance and repair and without a doubt are, in the long run, the most economical as well as the safest types of wiring for permanent installa-

* Presented at 1938 meeting, Code Committee, M. T. Crawford, chairman, Engineering and Operating Section, Northwest Electric Light & Power Assn., April 20-22, 1938, under the title "Economics of Wiring Design and the National Electrical Code."



tion in occupancies involving considerable life or property risk.

Economy is best exemplified in any kind of building equipment, by the size of the maintenance bill over a period of years. This is just as true of electrical equipment as it is of plumbing equipment and the industry which has the courage and foresight to sell the owner of a building the best of its equpiment, even though the initial cost of that equipment is higher, has always the satisfaction of having rendered the greatest service. Inadequate wiring methods not suitable for the type of building construction used, even though their first cost may be cheaper than other types of wiring, will prove every time to be dear and high priced in the long run.

Analysis of Wiring Costs

In my presidential address last year at the sectional meetings of our International Assn. of Electrical Inspectors I made an analysis of wiring costs for a six room residence, equipped for electric range, and having a total of 50 light, switch, and receptacle outlets connected. The figures obtained were most revealing and will bear repeating here.

The cost items shown for labor and material are actual costs taken from the books of a Portland electrical contractor specializing in house wiring. The data given covers a residence job similar to the installation shown in the accompanying sketch which illustrates the minimum wiring layout specified by ordinance in the City of Portland for range and light wiring in a residence occupancy.

The wiring methods employed in connection with this particular job included (1) rigid metal conduit for service conductors, with flush meter cabinet designed to accommodate the 3 meter sockets necessary where off-peak current is used for water heating; (2) electrical metallic tubing for the No. 6 range circuit, the exposed basement wiring, and the No. 8 sub-feeder to the panel on the first floor, and (3) armored cable for branch circuit wiring installed elsewhere than in the unceiled portion of the basement.

The exact cost items covering material and labor for this installation were as follows:

Material cost	
Service conduit, wire, and equipment	$13.96
Rubber covered wire for range and basement lighting circuits	5.67
Armored cable (582 ft.)	20.96
Electrical metallic tubing for range and basement lighting circuits	5.86
Outlet boxes including hangars	8.36
Switches, receptacles and plates	7.68
Total material	$62.49
Labor cost	
*Roughing in job	$16.00
Finishing	10.94
Total labor	$26.94
Total Labor and Materials	$89.43

* 8 Hours time (one man and helper).

The contractor's selling price on this job amounted to $130.00 which gives a distribution of the customer's dollar approximately as follows:

For wiring material and equipment	48%
For contractor (profit and overhead)	31%
For Labor	21%

It is of interest to note that the material required for the service alone costs $13.96, or almost one-quarter of the cost of all wiring materials used in the installation. This service cost includes an item of $3.50 for the flush meter cabinet but does not include the cost of meter sockets. Taking into consideration the adequacy and tamperproof features offered by a service of the type shown, I believe that even our utility executives will favor the necessary expenditure for this part of the wiring system.

Some of you may question what saving might have been effected in the service installation cost had service-entrance cable been substituted for the 1¼" rigid conduit. This very same question was put to our local code committee at the time it was considering a revision of the service provisions of the Portland code and was referred to a subcommittee composed of 3 utility engineers and 2 electrical contractors. It is my recollection that the report of this committee indicated a net saving for the cable over the conduit of only 28c. Those of you who may be interested in the results of this committee's investigation may ol tain further information by

addressing Mr. E. F. Pearson of the Northwestern Electric Co. who served as chairman of the committee.

Wiring Cost and Wiring Method

The total cost of this wiring job to the customer is $130.00, of which $41.00 or about 31 per cent of the total is dependent upon the method of wiring employed between the service switch and outlets, the remaining 69 per cent being determined by the cost of labor and material for the installation of service conduit and equipment, panel board, outlet boxes, receptacles, etc.

We are interested primarily in learning how much this item of 31 per cent may be reduced by a change in wiring method. Let us start from scratch by substituting for our metal enclosed conductors *ordinary rubber covered conductors run without additional protection through holes in timbers and stapled directly to the surface of the timbers.* This should represent about the most extreme lowering of standards which might be proposed by any group within the industry and the saving (?) gained by the use of such a wiring method should represent about the maximum which might be expected through the elimination of so-called "burdensome code rules."

The cost of labor and material for installing the lighting and appliance circuits when using unprotected rubber covered conductors stapled to timbers in lieu of armored cable and tubing will amount to $21.00, approximately or a saving of $11.00 over the protected wiring method. By discarding the one inch steel tube to the range outlet a further saving of about $5.00 will be effected, making a total possible saving of about $16.00 or 12 per cent of the total cost to the customer. We repeat here—can it be possible that this item of $16.00 which amounts to only 12 per cent of the total wiring cost and which represents the difference between reasonably safe wiring and positively dangerous wiring, is burdening the sale not only of kilowatt-hours but of wiring installations, utilization devices and appliances to the ultimate disadvantage of everyone? Is it not more probable that just the reverse of this statement is true and that kilowatt-hour consumption and appliance sales will be benefitted through the installation of dependable wiring which makes for trouble free service and a satisfied customer?

Utlity executives will please note that the $16.00 saving resulting from the use of substandard and admittedly dangerous wiring represents only 2.7 per cent of the total energy cost over a ten year period, based on an annual revenue for this installation of $58.98 (which is the average annual revenue per customer for range and light service in the Portland territory). Thus a difference of only one-fourteenth of one per cent kilowatt-hour will more than nullify any questionable economy which might be obtained through a maximum lowering of wiring standards. I ask in all sincerity—can we afford to take a chance?

Adequacy, Permanence and Safety

Economies of wiring design do not result from a choice of so-called low cost materials and methods designed possibly for installation by untrained, unregulated, and irresponsible persons. Such methods and materials too often sacrifice economy as well as safety. The safety is sacrificed by reason of too easy tamperability, leading to subsequent hit and miss additions and changes in wiring. The cost, over a period of years, measured in interruptions to service, cost of servicing, overfusing, overheating, burnouts, fire and fire insurance cost, is all against the merely low cost materials and methods. *Certainly no one does the public a service by making it easy for the wiring pathway to escape regulation, or for the electrical energy to escape out of its designed regulated pathway.*

After all, adequacy and safety are the two factors in interior wiring installations about which the utilities should be chiefly concerned, with cost running third in importance. The relative importance of these factors from the standpoint of utility has been ably summed up by an experienced engineer associated with one of our northwestern utilities. I quote from his written opinion the following statements:

"*Adequacy:* It is of vital interest to the utility that the installation should have sufficient capacity so that the customer may be able to use advantageously any electrical equipment that the industry may develop for his use. It is also important that the customer have outlets at as many locations throughout his installation as it is possible for him to use electrical equipment. This assures the utility that lack of convenience at least will not prevent the customer from using his equipment. These requirements do add to the cost of wiring, but I do not believe any utility would object to either requirement even though it did increase the wiring cost.

"*Safety:* The service entrance conductors should be installed in such a manner that it will be difficult for unscrupulous customers to use energy which has not been metered. Of course, only a few customers require this precaution, but since it is difficult to seggregate this peculiar group and single them out for special wiring requirements, therefore it is the accepted practice to require all services to be wired in the same manner. The method generally used is to require the service to be installed in rigid metal conduit or something that would provide the equivalent in protection from tampering and in the reliability of service maintenance. Other wiring methods than the conduit systems have been proposed but thus far none has been proved to be less expensive. This requirement is primarily in the interest of the utility and it is doubtful if any of them really want this standard lowered.

"As to the safety to the interior installation, it cannot be to the interest of any utility to have any change made that would increase the fire and accident risk. We are slowly emerging from the era when every fire which could not be clearly and definitely laid to some other cause was reported as caused by defective wiring. *Is it wise to undo years of education and effort along these lines for the sake of a small possible saving in wiring cost?* I cannot see any logic in such a backward step, even though we could close our eyes, ears and hearts to the humanitarian aspects. We are selling and urging the use of every kind of electrical appliance including electric toys and we are spending large sums of money advertising both directly and indirectly the safety of electrical service. We are justified in doing this because of the safeguards that have been placed about electrical material installations, and equipment, yet we well know that without proper safeguards electricity is dangerous. In view of these conditions the utilities cannot afford to advocate the lowering of safety standards. A list of actual instances of fire loss, personal injuries and death could be prepared if necessary to show that even with our precautions these losses are too high, but I believe that is hardly necessary."

In conclusion we ask can the electrical industry afford to waste time and effort quibbling over a possible saving in wiring cost amounting approximately to the price of *a couple of gallons of paint* when we consider that a good wiring job will last the life of the building whereas the paint job will probably last about four years? Would it not be a wiser policy to spend this time and effort constructively in aiding the public and industry to a safer, greater use of electrical energy by requiring adequate copper capacity in feeders and circuits, and an adequate number of circuits and outlets? It should be obvious that the more adequacy we can legislate in the code the nearer we shall approach to a constructive code, not merely a prohibitive one, and that is what we all want.

A JUNE PREVIEW OF THE FAIR

By CHARLES L. HUYCK
Graybar Electric Co., San Francisco

HERE we are in June—and the Golden Gate International Exposition is only eight months away! No longer is it necessary to build the story upon blueprints, as in our August 1936 issue, nor even upon that 400 acre brown drafting board, the Island, as in our Convention Number of last year. The Exposition is now three-dimensional, so suppose we take a ferryboat to Treasure Island (a touch which would have tickled Stevenson) and see for ourselves.

As we crawl crabwise toward it, we first notice a low coast defended by what seems to be a long low fort, topped by an occasional arch or a tower. This is really the back wall of the Fair, which faces inward. Coming closer, we see that it rises in three giant steps or cutbacks and that its huge 2,100-ft. sweep is broken by two great gateways. That wilderness of lumber—thirty million board feet of it—is upheld by an underground forest of ten thousand piles and is the compact main group of exhibit palaces, costing $8,500,000 and now 85 per cent completed.

The basic plan is simple—two parallel avenues from west to east crossed at right angles by another from north to south. Beautified by painting, sculpture, and landscaping, these avenues will later be transformed into the courts of Seven Seas, Flowers, Reflections, and other poetic monikers. They are enclosed within the walls of six buildings which have been cut into cake-like segments to make nine exhibit palaces 200 ft. wide, 60 ft. high, and from 400 to 900 ft. long.

The main avenue is headed by two entrance pylons, each occupying a city block of space and rising in giant steps, like a Cambodian dream of the lost Khmers, to serve as 120-ft. pedestals for colossal elephants. A smaller replica of this pachydermatic portal flanks the other west-east avenue, which is the ferry entrance and is geared to a "take" of as high as 70,000 visitors per hour.

The entrance gates are apparently a solid continuation of the walls, but they are really formed of parallel rows of tall shutters or "baffles" and are cunningly contrived valves to admit a maximum of visitors and a minimum of breeze.

Our electrical Mecca, the Palace of Electricity and Communication, is directly at the left of the main entrance and conveniently adjacent to the ferry entrance, thus providing a new low in footwork for single-minded enthusiasts, though if you desire to trace electricity in this Exposition you will find it everywhere.

The junction of the two main axes is the hub of the Exposition and is very properly surmounted by its most conspicuous architectural feature, the 400-ft. Tower to the Sun. Our brethren of the spotlight and color screen have planned to break all previous world records in their handling of this golden—or rather amber—opportunity.

As to the palaces, our perennial friends Transportation, Horticulture, and Machinery seem to be A.W.O.L. But just as the exhibits themselves are to be dramatic and exemplify principles in action rather than products at rest, so their enclosing palaces are named from themes rather than classifications; and thus we have Vacationland, twice extended and already 97 per cent booked; the Halls of the Mineral Empire and of Science; and the Palaces of Homes and Gardens, of Foods, Beverages, and Agriculture, and of Electricity and Communication. Horticulture has gone outdoors and woven itself, like electricity, into the fabric of the Fair.

Income from rental of exhibit space is estimated at $2,150,000, after allowing one-third for aisle space from the available 645,000 sq. ft. at $5.00 per sq. ft. rental charge.

Before getting down to electrical brass tacks let's consider for a moment the color scheme because it is an integral factor of the electrical illumination. The Exposition palette is pastel and based upon the colors of California wild flowers. It includes such reds as coral, taupe rose, and Pompeiian; such yellows as fawn, parchment, ocher and ecru; such greens and blues as emerald, jade, midnight, cerulean, and turquoise. The plaster body-color is yellow-ivory. No more than three harmonious shades will be used in any immediate vista, and the whole effect will be calming rather than exciting as in some recent "futuristic" fairs.

Jesse Stanton is the Color Chief and he is a key man in any group confer-

ence of officials. Electrical Chief William Van Bokkelen must tune his spots, floods, and fluorescent tubes just as instruments are tuned in an orchestra.

Recognizing the West's leadership in the production, transmission, and consumption of electricity, the directors of the Fair have resolved from its inception to make it pre-eminently an electrical exposition. We will accordingly consider: first, the installation; second, the outdoor lighting; third, the interior lighting; fourth, the Palace of Electricity and Communication; fifth, electrical exhibits in other buildings; and sixth, mainland participation.

The Electrical Installation

Delayed somewhat by prolonged rains and the prior construction of underlying sewer and water mains, field work is now proceeding on the electrical distribution system which fans out from the 16,000-kva. Island substation. Power is conveyed thither by three 9,000-ft. submarine cables, to be laid by September 1. There are ten miles of 4,000-volt underground feeders, 30 miles of street lighting cable, and several million feet of secondary wires.

The three right wing concrete buildings are wired as permanent structures, being the two hangars and terminal station of San Francisco's future airport. During 1939 the hangars will house the Fine Arts and Aviation exhibits, and the terminal will be the Administration Building, with such lighting modifications as may be needed to convert its concourse to Exposition needs. The other palaces are wired as temporary structures. Their wiring is in conduit; all decorative installations are knob and tube.

All this work is under the direct supervision of William R. Van Bokkelen, Chief of the electrical division, and George Garthorne, his assistant. One million dollars has been budgeted for electrical installation and illumination; power consumption during the 288 days duration is estimated at forty million kw-hr.; $225,000 will be realized by estimated sale of current to exhibitors.

Outdoor Illumination

One of the earliest Exposition contracts was awarded the General Electric Co. for the outdoor lighting. The result is the largest order of its kind ever placed anywhere, comprising 9,000 floodlights and fluorescent tubes valued at $170,000.

About 3,100 pieces are handy small floods of 200 watts or less; regular Boy Scouts whose daily good deed will be to grip the nearest architectural or decorative feature in their glare. Trees will be left dark because of the contrast between their dark masses and the background of pure light—a trick the great landscapist, Turner, played to perfection.

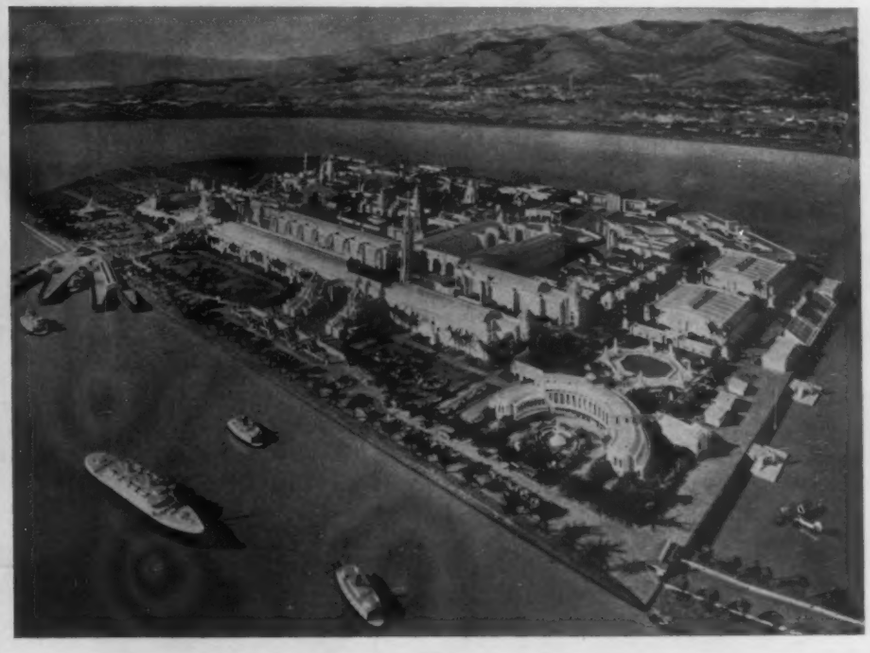
Muzzle to muzzle, the massed batteries of big floods will illuminate the sweep of the outer walls. For their huge surface and cutbacks, 2,750 floodlights ranging from 250 to 1,000 watts were included for these general purposes, and 125 1,500-watt searchlights, 18 in. in diameter, specially designed. To prevent a static effect, all exterior plastering has been treated with "zonite," containing minute particles of mica and imparting a sparkle and life to the walls whose whitewashing would have occupied Tom Sawyer and his pals a lifetime.

The fountains, too, will sparkle—"like champagne" promises the publicity expert, a bit effervescent himself—because the water is to be strained through fluorescent pigments, and deep in every pool will be submerged floodlights to bathe their lilies in watery sunshine from sunken suns. No fewer than 270 submarine floodlights of two sizes, 250-400 and 500-1,500 watts, are being designed for this service.

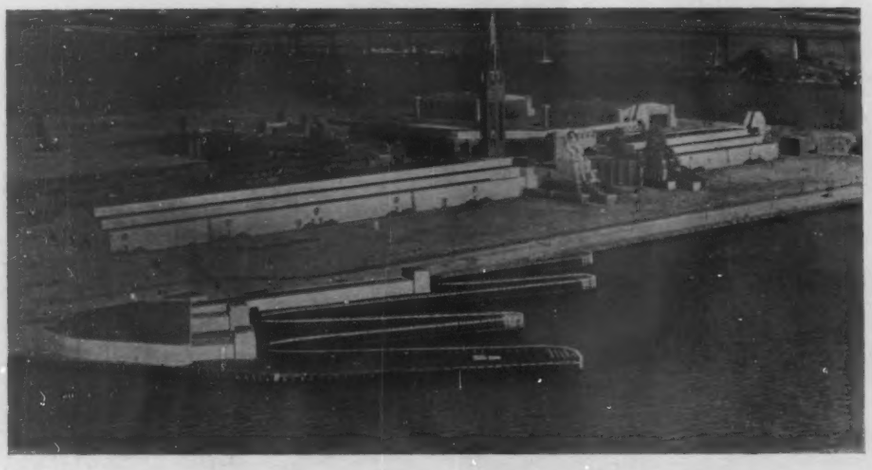
Even the mural paintings will be touched up by fluorescent paint played upon by the "black light" of ultra-violet floods. There are 300 of these, sizes 100 and 250 watts.

It is the 2,300 fluorescent tubes on the order which have set electrical expectation on tiptoe to peer over the threshold into what may be a new school of lighting. They are rated at 15 watts 120 volts, are 18 in. long, and each is mounted in a metal trough reflector with its own built-in transformer, condenser, and choke coil. The tubes are inside-coated with fluorescent powders, converting invisible ultra-violet rays from mercury vapor into visible colors of green, blue, pink, or amber.

"This new light source provides colored light at efficiencies hitherto unattainable," says "The Magazine of Light" in its May issue, "in some cases producing as much as one hundred



Opposite page—Construction goes on apace, walls rising to right and left. Above—Looking down from the Tower of the Sun. Right—Accurate scale model of the fair grounds



Aerial photograph shows the great strides being made on the island

times the illumination for the current consumed as filament lamps of the same color." It is intended to manufacture them commercially in 15, 20, and 30 watt sizes in lengths of 18, 24, and 36 in. and in colors of blue, gold, green, pink, red, daylight, and white.

A sample of each of the outdoor light sources would comprise a very pretty pageant in themselves, including 75-ft. cylindrical lanterns, Siamese ceremonial umbrellas in spun glass, flanged glass rims for the pools, scintillators for local auroras, and the like. But the heart of all these agents, whether Siamese or not, will hail from Schenectady.

The Gay Way concessions (from which it is hoped to realize $2,170,000 on the basis of 10% of their receipts) will naturally run riot in their electrical ballyhoo, but nevertheless certain standards will be required even of them, as well as from the state, nation. and isolated private exhibitors, and no nudist colonies of naked lamps will be permitted.

Bay Bridge sodium electroliers will light the six lane ramp around the western face of Yerba Buena Island down to the Fair.

Interior Illumination

Proceeding indoors, we next consider the interior illumination. The central group of exhibit palaces will be lighted uniformly, excepting the Art Palace, whose Old Masters and "Young Messers" require tender treatment; the Administration Building, obviously; and the Electrical Palace, where electrical men are hoping that the decorative strip layout submitted by Rodney Doerr and his committee will be installed, because it is almost necessary where so many exhibits mount almost up to the root trusses, and also because this will be the electrical host palace. All the others will be treated industrially.

An initial order of $14,000, covering 1,200 Alzak aluminum drop bay reflectors of various sizes and styles, has been placed with Westinghouse Electric & Manufacturing Co., whose San Francisco illuminating engineer, Fred Wellhouse, cooperated in the layout. Seven hundred are to be mounted directly on the great arching girders supporting the roof, ranging from 750 watts near the walls to 1,500 watts in the center of the great halls, 60 ft. above the floor. This plan preserves unbroken the lofty arch of the roof and judicious spacing will give 13 foot-candles over the exhibit area, augmented by the lighting of the individual exhibits.

The second group of 500 500-watt size will be clamped on convenient exhibit structures or on standards and will throw their light upward. The woodwork is yellow; the floods have straw colored screens; the result will approximate "synthetic sunshine," a very real illusion, for remember that these gigantic halls are windowless and are officially open every day from 10 a.m. to 10 p.m.

Electrical Building

The Palace of Electricity and Communication is a two acre structure in a highly eligible central location as befits the "playing captain" of what is really an electrical team.

Across one end will be the monster diorama of the Pacific Gas and Electric Co. portraying the magnificent—though every day—pageant of power and light from snowflake to socket. In its own 7,000 sq. ft. of space the American Telephone and Telegraph Co. will reveal some of the research technique of its world-renowned Bell Telephone Laboratories. General Electric will present veritable black magic from The House of Magic, and Westinghouse will introduce their all-but-human robot.

Commercial aviation and radio were born in the travail of that most tragic of all World Shows, the Great War. Perhaps commerce will also be enriched from this exposition of Peace, whose exhibits include the first American preview of television with cathode rays; broadcast facsimile service, delivering printed type and pictures FOB your radio set; and the possibilities of fluorescent light.

Says the chief of this palace, the widely experienced Arthur Halloran: "We aim to portray, by dramatized exhibits, how electricity enables people to live more comfortably and happily." Here will be the first large scale use of "black light" to exemplify right and wrong methods of wiring. Air conditioning will be shown not as a name or a creed but as a necessity in action. There will be pest killers and a citrus X-Ray for frost-bitten segregation, and model farms, and many ingenious methods of impressing electrical usefulness upon memories for future *action*.

Other Electrical Exhibits

Spectacular electrical exhibits will be found in nearly every other palace because, as we emphasized, electricity pervades this Exposition. Electrical mining machinery and safety appliances will be found in the Hall of the Mineral Empire and under its forty foot "Treasure Mountain." Vacationland would be Never, Never Land without electricity as a transporting, welcoming and comforting agent.

The Hall of Science, our neighbor across the court, will naturally contain many gadgets propagated by busy electrons, such as a pioneer Roentgen ray machine, a hall to test acoustics and human responses to vicious noises, short wave radio apparatus, chemical gardens, and radium reactions upon our glands, tissues and juices.

Mainland Participation

Beside the Exposition illumination and its dual replica in the basalt-like waters of the Bay, it is planned to key up San Francisco itself to a corresponding lighting intensity, and an Electrical Development League committee headed by Ralph Wiley, Electrical Chief of San Francisco, is now actively engaged upon a campaign of publicity, education and action toward that goal. It has been strongly urged that the ramps of the Gate and Bay Bridges be connected by a lane of modern electroliers along Market Street and Van Ness Avenue, that such world-famous landmarks as Chinatown, Fisherman's Wharf, and Golden Gate Park be permanently floodlighted, that all conspicuous public, commercial, industrial and domestic buildings be illuminated effectively, inside and out, and that the great Bridges light up for the festival of which they were the primary spark plugs.

Not in the Manual of Arms

(A Sales Editorial)

DOWNHEARTED? Then listen to a true story told here just the other day. Count four months —120 days—multiply it by hours—and you get the sum total of worry that had eaten at this dealer's morale. His was not a lone experience either—for everyone in town, in the region, had been up against the same thing. He had been to war and war had been hell, but this—

For the last two of these multiplied hours, spent together after dinner, the two men sat talking, talking over the lack of business and what might be done about it. With the dealer was a distributor, George Lloyd, and the latter felt it his duty not to let his dealer, one of the best he had too, get down in the dumps too far. The distributor said afterward that most of his cheering suggestions had seemed to bounce right off the cynicism of his friend the dealer.

Then there was silence for a few minutes while each drew smoke from his cigarette thoughtfully. It seemed almost as if everything worth saying had been said. In another minute or two both might have bid each other goodbye and departed.

The dealer finished his cigarette, put it out deliberately and carefully in the ash tray as he watched the last wisp of its smoke die out. He seemed to pause. Then with a surprising vehemence he said, half aloud, half to himself,

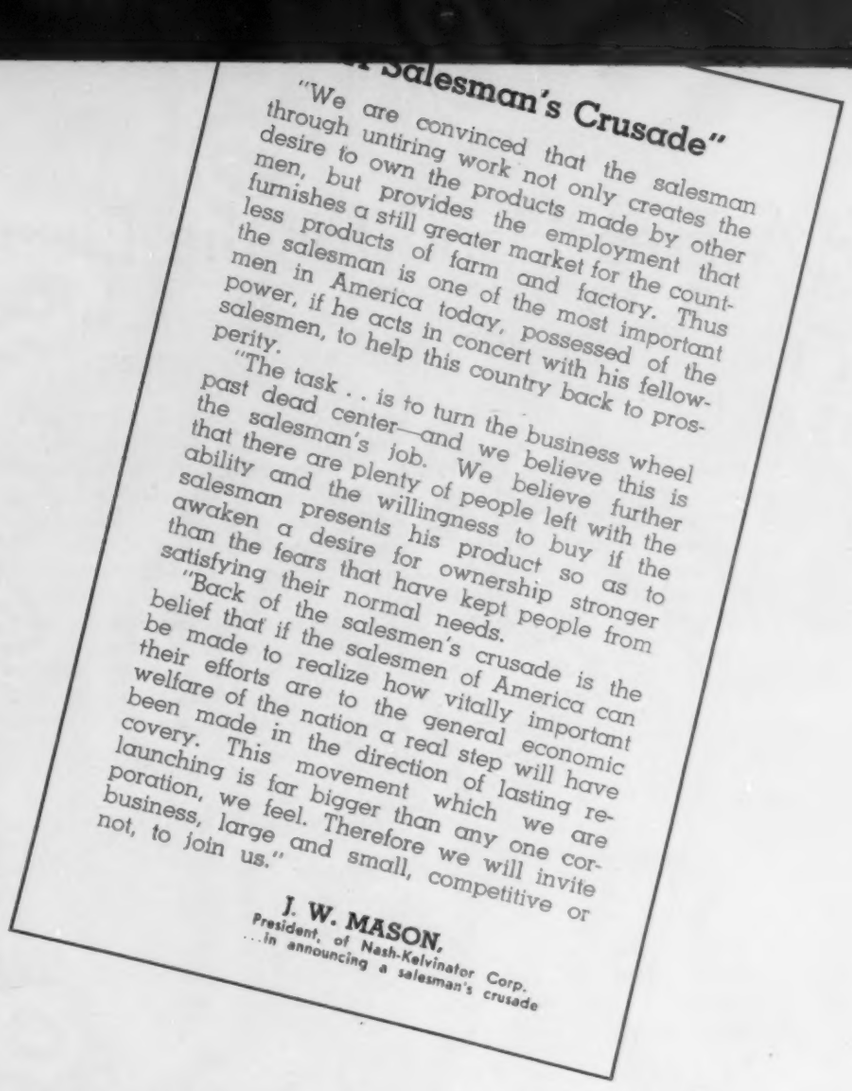
"I've been a damn fool, a quitter!"

"How's that," asked the distributor taken aback by the intensity of the statement.

"I just remembered something, something I shouldn't have forgotten."

It was better just to let him talk, so George sat still, waiting.

"You know, when we went into the war, back in 1917, I was sent up to Camp Lewis. We hadn't been there but a couple of months before the orders came through to move on overseas. And we weren't in France long before the outfit I was with was moved up to the front. We were as ready, I suppose, as about six months of training every day could make us, which wasn't very damn much.


Salesman's Crusade"
"We are convinced that the salesman through untiring work not only creates the desire to own the products made by other men, but provides the employment that furnishes a still greater market for the countless products of farm and factory. Thus the salesman is one of the most important men in America today, possessed of the power, if he acts in concert with his fellow-salesmen, to help this country back to prosperity.
"The task . . is to turn the business wheel past dead center—and we believe this is the salesman's job. We believe further that there are plenty of people left with the ability and the willingness to buy if the salesman presents his product so as to awaken a desire for ownership stronger than the fears that have kept people from satisfying their normal needs.
"Back of the salesmen's crusade is the belief that if the salesmen of America can be made to realize how vitally important their efforts are to the general economic welfare of the nation a real step will have been made in the direction of lasting recovery. This movement which we are launching is far bigger than any one corporation, we feel. Therefore we will invite business, large and small, competitive or not, to join us."
J. W. MASON,
President, of Nash-Kelvinator Corp.
...In announcing a salesman's crusade

"The morning we were to start up for the line our captain called the company to attention and gave us a little pep talk before we started for the trenches.

" 'Well, men,' I can hear him yet, standing in front of us that wet cold morning before the sun was hardly up. 'We are going up front. It is what we came over here to do. What we find there is going to be new experience to all of us, but we've spent all the last six months preparing ourselves for it in everyway we knew how.

" 'You have been all through the manual of arms now, from back to front. It told us what to do under all circumstances. I hope you men remember it when you need it. If you don't it may be too late to learn over again. At any rate you seem to know what you are supposed to do, and I expect you to do it.

" 'There was one thing I noticed about the manual. I don't know whether you noticed it or not. But it didn't say what to do in *retreating*. They just left that chapter out of the book. And since it was left out of the book, I think maybe we'd better leave it out too.' "

Looking steadfastly at the dealer, the distributor said nothing. It was best not to talk just yet.

"We didn't retreat—never. What the captain said that morning has stuck with me ever since. I meant never to forget it. But I must have forgotten it just lately, for I *have* been retreating. I have been retreating in the face of business conditions, but I'm through right now. No matter what happens, I'm going home tonight and from tomorrow on I'm going to remember that there is nothing in the book about retreating. There isn't going to be any retreating from now on."

* * *

Back to his town went the dealer. And he did make a right about face, for there is no retreat in him now. He ditched his pessimism and went to work as if there never had been such a thing as depressed business conditions. The strange thing about it is that at last reports he had uncovered sales even where no one suspected them to be before. He is doing far better than anyone, even his friend the distributor, had hoped.

* * *

Is there a page on retreating in your sales manual? Since it has been left out, how about leaving it out of selling, too!

A Free Hand for the Electrical Industry

By W. C. MULLENDORE
Executive Vice-President, Southern California Edison Co.

ONE OF THE characteristic ingratitudes of humanity seems to be particularly prominent in our generation. I refer to the tendency to assume that the material blessings with which we are surrounded were the gifts of Nature conferred upon us without the intervention of human effort or striving. Such an attitude not only leads us to demand enjoyment of these blessings as a natural birthright, but also to ignore the debt we owe to the long years of creative endeavors, of strivings, and sacrifices which were required of those who pioneered and developed these things which we take for granted. In attempting to make an estimate of the progress of the electric power industry, it is well, therefore, to recall some of the steps in the development.

For untold centuries there have been available to mankind the raw material and sources of energy which today are utilized for the production and distribution of goods and services which make up the standard of living of modern man. Why were these goods and services not developed at an early date? What was it that was lacking? The answers may be given in two words: knowledge and enterprise.

Production requires raw material plus energy, plus the intelligent application of that energy to raw material. The explosive advance of the last fifty years in the production and distribution of goods and services has not been due to the recent discovery of the raw materials. It has been due to the discovery of new means of harnessing energy. That form of energy which we know as electricity has been the greatest single factor in the strides which production and distribution have made. Again, however, electricity—at least the fact that there was some such force—has been known for 2,000 years, but the method of producing it and of harnessing it and of distributing it waited for the discoveries of the great pioneers and creative spirits whose names stand out in the history of our industry.

Early Contributions

A great deal of basic knowledge concerning the characteristics of electricity was contributed by the students and experimenters of the eighteenth century. Among these were the Englishmen Stephen Gray and William Watson, the Frenchman duFay, the Italian Volta, and the American Benjamin Franklin. Then in 1831 came Faraday's great discovery of the basic principle of the modern generator, and in 1873 Gramme of Belgium made the discovery which made possible the development of the electric power motor. There followed the development of the electric arc light in the 1870's, to which development the American, Charles F. Brush, made important contributions. Then came the incomparable Edison with his invention of incandescent lighting and the establishment by him on September 4, 1882 of the world's first central station located on Pearl Street, New York City.

55-Year Yarkstick

Between that first Edison central lighting station, with its 59 customers and the present 25 million customers of central stations in the United States alone there intervened only 55 years. Speaking of yardsticks—there is one yardstick by which we may assume progress in the electric light and power industry under private enterprise in the United States!

After the establishment of Edison's first central station, inventions and their development began to multiply: Stanley's invention of the transformer in 1886; Westinghouse's development of the alternating current system in the same year; Tesla's invention of a new system of alternating current generators and motors in 1888; water-power generation beginning at Appleton, Wisconsin in 1882, followed by the beginning of the development of the water-power resources of Niagara Falls 11 years later.

But even at the beginning of the last decade of the nineteenth century, only a start had been made on that feature of modern electric service which has made it the universal servant which it is today. I refer to the development of distribution through long-distance transmission lines of high voltage—a development in which great steps were taken by the pioneer engineers working for some of the western power companies.

Without in any sense disparaging the great contribution of steam, it is only fair to remark that its range of practical use is limited to a very small radius. It has remained for electricity to offer something so flexible that it will operate a dentist's drill or a 10,000-hp. rolling mill, both of which may be 200 miles or more from the prime mover.

We can measure the energy of the kilowatt-hour as the equivalent of the energy expended in the work of one man working a ten-hour day. Yet we today may purchase and use our electric energy in amounts so small that it can be measured only on a highly sensitive instrument. For example, when you shaved with your electric razor this morning, you purchased through your electric meter about 1/500th of a kilowatt-hour, which at the average residential rate cost you about 1/100th of one cent. Back of that possibility of utilizing electric energy in such minute quantities, under such absolute control, and at such infinitesimal cost there was not only the genius of the man who invented the electric razor but the genius, the persistence and the labor of those forgotten men who made the refinements in the development of the distribution and control of your electric servant.

And yet we have mentioned only fragmentarily the high spots in the story of the progress of the electric power industry. The alternating current generators placed in use at Niagara Falls in 1893 were 5,000 hp.—five times more powerful than any of their predecessors. Today generators, both steam and hydro, with capacities in excess of 100,000 hp., are in common use.

Steam Turbine Progress

We need also to remember the remarkable progress in the efficiency of steam turbines. Twenty-five years ago the average requirement for generating one kilowatt-hour of electricity was 3½ pounds of coal, while today with the latest high-pressure steam turbine, the central station can produce the same amount of energy with the combustion of less than one pound of coal.

Those material things which constitute the American standard of living are largely the result, as has been said previously, of the application of energy to raw materials, plus intelligence stimulated to the making and direction of this application. Our raw materials may be lumber, brick, paint, cement and nails. When energy is intelligently applied to these, the product is a house. Other commonplace articles result from the every-day application of well-known methods, but in addition to this, we observe intelligence at work in a laboratory with the result that two commonplace elements are combined in a new way to give us something heretofore unknown.

Now let us note how perfectly the progress of the electrical industry fits into this picture, offering as it does a

reliable, abundant, economical, flexible and mobile source of energy. It is more than abundant—it is unlimited. The first commercial electricity was sold in 1882. Last year, sales totaled 115 billion kilowatt-hours, with the prospect of increasing sales volume as far ahead as we can see into the future.

That the industry is the product of individual initiative and private management is demonstrated by the fact that about 94 per cent of all the electricity consumed in the United States comes from private plants.

Its record is one of a steadily improved product and constantly lowering rates. In the early days, 25 cents was the cost of a kilowatt-hour to the average residential consumer. Since 1913, the average domestic rate has decreased from 8.7 to 4.5 cents per kilowatt-hour. Meantime the cost of living is 50 per cent higher than 1913 and going up.

Between 1919 and 1937, the number of farms having electric service was multiplied by eleven. From 100,000 to 1,100,000.

Between 1909 and 1929, the number of motors (expressed in horsepower) increased from 1,749,031 to 22,706,857.

There are approximately 1,625 privately owned electric utilities located within the continental limits of the United States, employing a quarter of a million people, and rendering electric service to approximately 40,000 incorporated communities and unincorporated towns and villages, and to 1,100,000 farm customers and a similarly large number of scattered non-farm customers. They serve about 26,500,000 customers of all classes and produce at the present time approximately 115,000,000,000 kw.-hr. annually, for which these customers pay approximately $2,000,000,000.

5,000,000 Security Holders

These utilities have an investment of approximately $13,000,000,000 which is the concern of about 5,000,000 security holders, people in all walks of life. A large proportion of the bonds of the utilities are held by life insurance companies, savings banks and by educational and other institutions.

The privately owned electric utilities pay heavy taxes in support of local, state and federal government. For the year 1936 these taxes amounted to $285,000,000 or 14.6 cents out of every dollar of gross revenue received from the sale of electricity. It was equivalent to about 70 per cent of their net income. For 1937, the tax figures will be considerably larger.

Not only has electricity contributed directly to better living and working conditions, but it is also the agency which has made possible refinements in industrial processes, bringing a great line of better products to the public.

We get our information about what is going on in the world with amazing speed because of electrical devices—telegraph, linotype, high speed presses, stock tickers, radio.

The foregoing facts are well known. There is little dispute about them. It is now generally admitted that in the short space of a quarter century these enormous strides have been made in the utilization of electricity, in putting it to work, in making it the indispensable servant of mankind which it is today.

There is not, however, such general agreement as to what was responsible for the development of this availability; this putting electricity to work. What was it that made those enormous strides in progress possible? Did they just happen? They did not.

Along the road from the 125-hp. dynamo generating current at 110 volts to the great central stations of today using dynamos of more than 100,000 hp. and transmitting at voltages as high as 250,000—along the road from the 59 customers of the Pearl Street station to the 26½ million served today, there has been a driving force. Something other than mere good fortune; something besides natural resources was responsible for these constant developments; for their marketing, for their sale. What was it? The work of man. And the spur to these hundreds of thousands of men and women, the spur to them in taking their losses and their risks was the system of free enterprise—which means opportunity, which means the chance to earn a profit, to be acclaimed for success, yes, but to be materially rewarded for success too. Freedom and reward—the reward of a material kind and the reward of applause and honor for a job well done. That, too, is American enterprise.

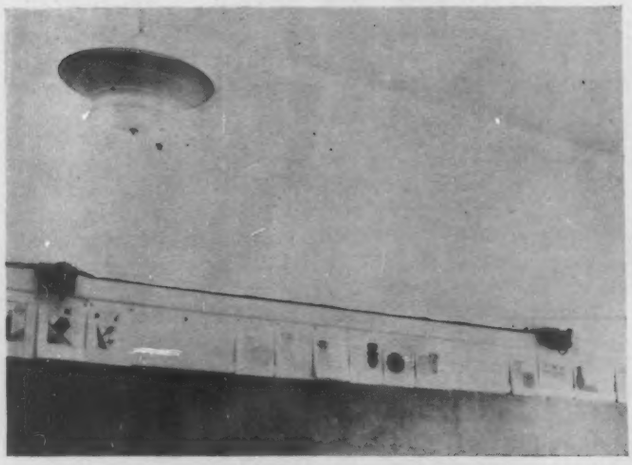
The foregoing facts are matters of history and present records. There is, as we have said, room for little dispute about them. Neither is there dispute about the indispensability of electric service in the daily life of our people. The facts as to the progress of the industry are too well established to permit of controversy. They are the pride of our citizens and the envy of other countries.

The controversy about this progress, insofar as there is a controversy, seems to be whether it has been because of or in spite of our private enterprise system, and whether more might have been accomplished under government ownership. While there may be no method of actually proving to the satisfaction of the government ownership enthusiast that government ownership would not have accomplished as much in the development of the applications of electricity and the expansion of its distribution and availability, we may call upon human experience to prove that always it has been under a system of free enterprise that such outstanding advances have been made. They were the products of men and women toiling long hours in laboratories and field, spurred on by that determination and ceaseless striving which has flourished only when men were free and working under an enterprise system.

Private Enterprise Must Continue

To contend that the immeasurable additions which electric service and its means of utilization have made to the material advancement and the standard of living of the whole population of the United States would have been possible under the management of agencies and agents selected largely through political processes and enmeshed in the inevitable red tape of governmental activities is to assert facts contrary to centuries of human experience and to repudiate the system which has been pointed to throughout the civilized world as our country's greatest contribution to the advancement of the problems of social living.

We may then inquire whether we should, in the interests of human progress, abandon or regulate out of existence this system within which these achievements were made. Surely the end is not yet. Surely we have not achieved a finished world. Improvements of the system are possible just as improvements of our scientific methods of production are possible. There are yet great problems before us, the solution of which will contribute greatly to the forward march of this and other industries. The momentous question which must be faced even now by this generation of Americans is whether we shall retain and continue our advance under the basic principles of the system of free American enterprise—a system which has neither broken down nor failed but which has gloriously achieved for the benefit of all mankind!



Both photoelectic relays are tilted slightly toward the desk level to bring response to lowered lighting levels on the working plane

More Light for Young Eyes

A Vallejo, California, Grammar School Conducts an Important Experiment Into the Value of School Room Lighting

LABORATORY test methods should settle many of the arguments revolving around the problem of school room lighting in the present era. The pressure of school operating costs has moved school superintendents and boards in many communities to a supercaution which seizes upon any doubt as to the value of lighting as an excuse for inaction and deliberation. Whether the claims of the lighting and power industry have been too sanguine or whether the counter claims of Consumers Research, with its socially minded distrust of business, have been overinfluenced by a dislike for the electrical industry, right or wrong, has had most school people between the horns of a dilemna. They have been sincerely interested in protecting precious eyesight of the children under their charge, but in whom could they believe? How much light was enough, and therefore economical, and how much light extravagant? What kind of light, and what kind of equipment should be selected from amid the maze of conflicting claims made by various manufacturers and distributors?

Such problems beset Mr. Elmer M. Cave, superintendent of schools, at Vallejo, Calif. So he turned to the one institution in whose impartiality and scientific purpose he had faith, the Sight Conservation Council of Northern California, to help him conduct a two year, thoroughly scientific test with two classes of pupils in his MacKinley grammar school. One room was left as it was, the other completely reconditioned and lighted in accordance with specifications prepared by Dr. Leland H. Brown, of Stanford University illuminating engineering department.

Both rooms have the same Eastern exposure and hence identical natural light conditions. The reconditioned room was repainted to specifications, the ceiling a flat white of 80 per cent reflection factor to which a touch of the green tint of the side walls was added. Other details of the interior finish were specified also after a thorough survey of the premises. For example:

Upper wall, picture molding, transom window frames and glass, the door panels, and the window sash were painted a semigloss green tint having a reflection factor of between 65 and 70 per cent. The pin boards and the door frame were painted a slightly darker semi-gloss green tint, with reflection factor of 50 per cent. Lower walls, door and window casings and the baseboard were a bit darker tint of green, with reflection factor of 45 per cent. The radiator was painted a dark bronze. Included in the recommendations were that the pin boards above the black boards be renewed, and the first blackboard panel next to the door, at the front inner side of the room, be covered with celotex and thus converted into a pin board rather than to attempt to use it as a blackboard.

Lighting installed consists of six 500-watt, totally indirect luminaires, 30 in. from the ceiling, in two rows; the first 6 ft. from the windows, the other 6 ft. from the inner wall, leaving a 12-ft. space between rows. The classroom is 24x32 ft. in size. Spacing in the other direction was 5 ft. from each wall, and 11 ft. between each luminaire. Wiring was provided for 750-watts per outlet, the luminaires being lamped initially with 500-watt lamps. Luminaires were specified to have 65 per cent efficiency, producing an average ceiling brightness not exceeding 125 ft. lamberts, with a limit of brightness at any point either on the luminaire, canopy or husk, or ceiling not exceeding 250 ft. lamberts (½ candle power per sq. in.).

Two photoelectric relays were installed to control the artificial lighting in the test room, one relay in parallel with the wall switch operating the inside row of three luminaires, the other with the outer row. Both relays are set to turn on the light when the illumination level in the room drops to 15 ft. candles, and to turn off when the level reaches 40 ft. candles. This is based on the assumption that the lighting system will provide a level of exactly 20 ft. candles of artificial illumination. Two photocells were used in this experiment in order to eliminate the human factor in the maintenance of the lighting levels. In the Sight Conservation Council recommendations Dr. Brown suggests that the second photocell relay be used for another room later, as one relay should be sufficient for a room under ordinary circumstances.

Pupils of both classrooms, the 5th and 6th grades, were given a series of three mental and achievement tests by Gregory Inglehart, of the California School for the Blind, of Berkeley, on Jan. 20 and 21. These included the National intelligence test, which helps to rate the mental age of the student; the Sangren-Woody reading test, which determines reading speed and comprehension; and the Stanford achievement test, which grades the general ability of the child. These data, together with the chronological ages of those tested, were then used to pair off into two relatively equal mental groups the students in the two rooms. Thus paired against each other the mental age, comprehension, speed, and general ability of the two groups has been adjusted to provide as nearly equal an opportunity for progress as can be made possible.

Right, the "control" or unlighted classroom, and, above, the reconditioned and relighted classroom at MacKinley school, Vallejo, where the 2 year test is being conducted. Photo-electric relays can be seen mounted on the rear wall in parallel with each row of luminaires. The inner row of luminaires seems to be in operation almost continuously, the teacher reports, indicating a deficiency of natural light even on bright days. Photos were taken with identical film and exposure on a sunny day

Physical tests, such as eye examinations, were not feasible because of limited funds, but the routine physical and seeing tests given by the health department were given these children.

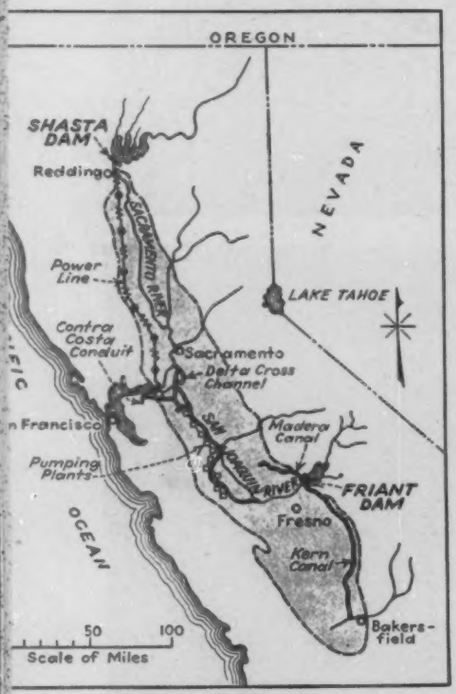
On June 6 and 7 Mr. Inglehart will make a second series of tests for reading ability and speed and another of the Stanford achievement tests. Next year two similar sets of tests will be made at 6 month intervals. From these data will be determined if possible just what improvement in scholarship can be traced to good lighting. It will be difficult, under the circumstances to make more than an observational test as to the condition of the eyes of the two test groups, but as nearly as possible this will be done also. Interested in the project, teachers of both rooms and the principal of the school are cooperating to make the test as fair and conclusive as possible.

So far the difference between the two rooms seems to be chiefly psychological, the teachers report. The cheerfulness of the reconditioned room in comparison with the old room accounts for this. Whether the adaptability of the human body to adverse conditions by the expenditure of extra energy to compensate for the deficiency in environment will make up for the handicap of poor lighting remains to be determined. This is such a subtle and unmeasureable factor that the outcome of this careful and objective experiment may still leave the conclusion in doubt on this point. Nevertheless this test of school lighting will be watched with interest by the electrical industry, school and educational authorities, and the medical profession.

Engineering Snapshots

POLSON DAM, which together with the powerhouse is officially designated Flathead Hydro-Electric Project, began functioning in April, when the diversion tunnel was closed. In 35 hr. 45 min. water had reached the crest and spilled 172 ft. to river bed. Montana Power Co. plans to begin operating a 56,000-kw. unit this summer. Powerhouse, to accommodate two units, appears to the right of the dam. With the 14 gates raised, Polson Dam will impound more than 1,000,000 acre-ft. nearly 200 ft. above river bed. The arch dam is 650 ft. long built by Phoenix Engineering Corp.

RUBY DAM (below) will function first only as a unit for controlling flow to Seattle City Light's plants on Skagit River. The diversion tunnel, upstream portal appearing in foreground, was but recently holed through. Foundations are being prepared. To be built just beyond the promontory at left, the dam will at its initial height (150 ft.) scarcely be high enough to show from this viewpoint, but if carried to its ultimate 575 ft. for development of 360,000 kw. would block out the peaks in the background



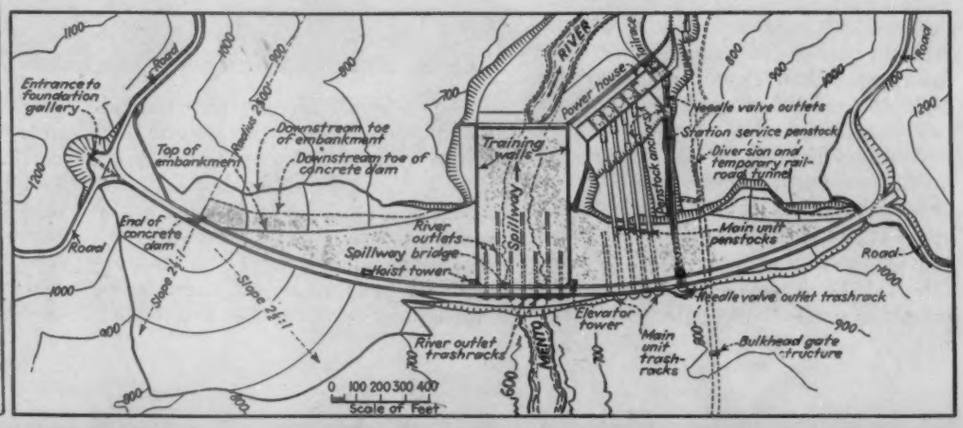
SHASTA DAM, for which bids were to be opened June 1, will be the key unit in California's Central Valley Project. Its height is 560 ft. Providing 4,500,000 acre-ft. of storage, the dam will embody 5,400,000 cu. yd. of concrete and will be 3,500 ft. long at the top, 2,860 ft. of this along the gravity section. Compared to Boulder it will, roughly, have 70 per cent more concrete but will be only 77 per cent as high. Compared to Grand Coulee it will have but 56 per cent as much concrete but will be 27 per cent higher.

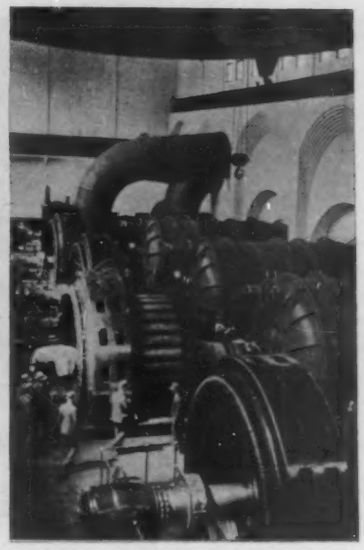
Initial power development will consist of four 70,000-kw. units, and a fifth unit will ultimately raise capacity to 350,000 kw. Initial bids will be for two machines. The 100,000-hp., vertical-shaft turbines will operate under heads of from 242 to 479 ft.

The map at left indicates Shasta Dam's place in the $170,000,000 Central Valley Project. Of Shasta's storage, the top 500,000 acre-ft. will be used for irrigation, flood control and other purposes. The same amount at bottom will be needed to maintain minimum head.

Plan and sectional views of the dam and powerhouse appear below.

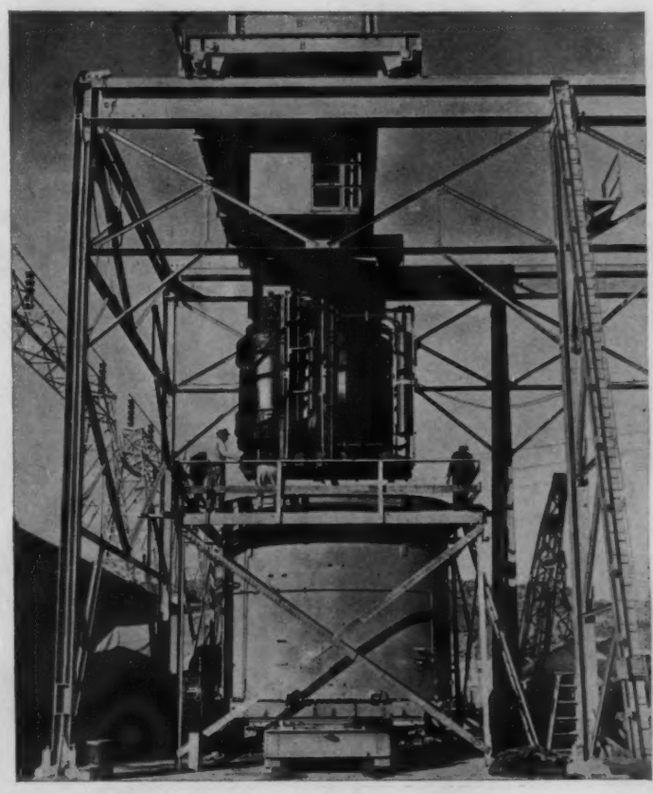
Allowing a 30-month head-start on construction of Shasta Dam is adoption of a scheme whereby the Southern Pacific R. R. is temporarily routed through a tunnel near the west abutment of the dam. Thus dam work can proceed concurrently with the building of the 30-mi. railroad line which will permanently skirt the reservoir. Later the temporary railroad tunnel will be used for water diversion

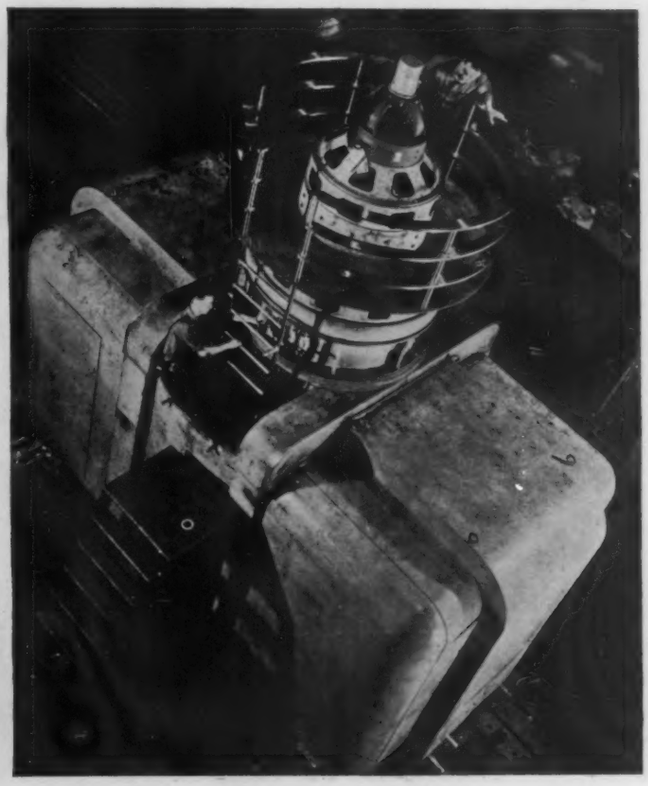


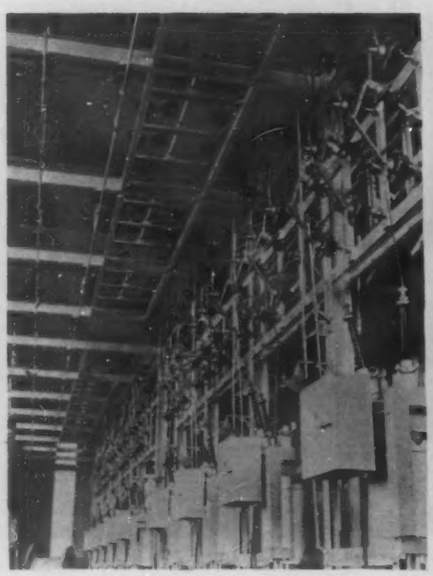


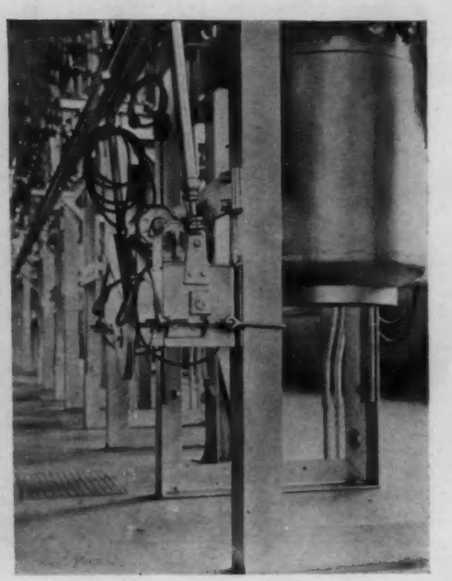
NORTHWEST ENGINEERS stepped into Canada this year for the first section meeting to be held outside the United States. Above left is a group inspecting switch structure atop the Ruskin powerhouse, and at extreme right are delegates inside Stave Falls powerhouse, both B. C. Electric Railway Co. plants. Fifty-odd members joined the tour which wound up the convention. At center are Scotch bagpipers leading a parade to the luncheon which was held jointly with the Vancouver Electric Club. On the first step are E. E. Walker, who was master of ceremonies, with Mrs. E. E. Carpenter, who acted as hostess to the lady visitors. On the step above are (left) W. C. Mainwaring, association president, and (right) A. Vilstrup, convention chairman

METROPOLITAN WATER DISTRICT photographers turned their cameras on the transformer (below left) just as it was being lowered into its shell on the transformer rack at Gene pumping plant. Furnished by General Electric, these 22,000-kva., 230/6.9-kv. transformers are fed over the district's transmission line from Boulder, and from their low-voltage side furnish energy to the pump motors. At right is one of the pump motors at Westinghouse's East Pittsburgh Works. It is 12,500-hp., 6,900-volt, 3-phase, 60-cycle, 450-r.p.m. vertical, synchronous, weighs 222,000 lb. It will drive a single-stage centrifugal pump at Eagle Mountain plant, rated 200 cu. ft. per sec. against 440-ft. head. The pumps, largest high-head, single-stage ever built, have been furnished by Worthington. Located on the desert 200 mi. east of Los Angeles, Eagle Mountain is one of five aqueduct pumping plants which will lift 1,000,000 gal. of water per day a total height of 1,600 ft. over the mountain barriers between the Colorado River and southern California's coastal plain







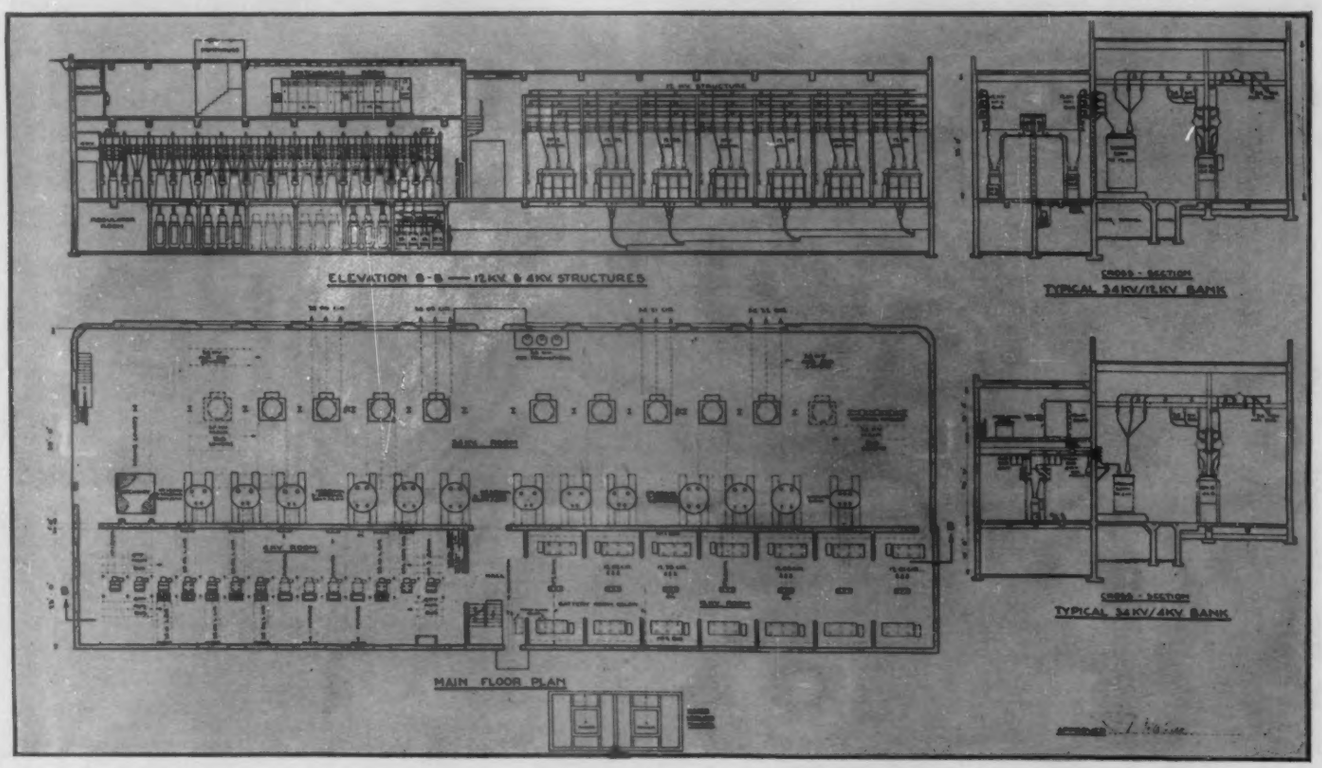


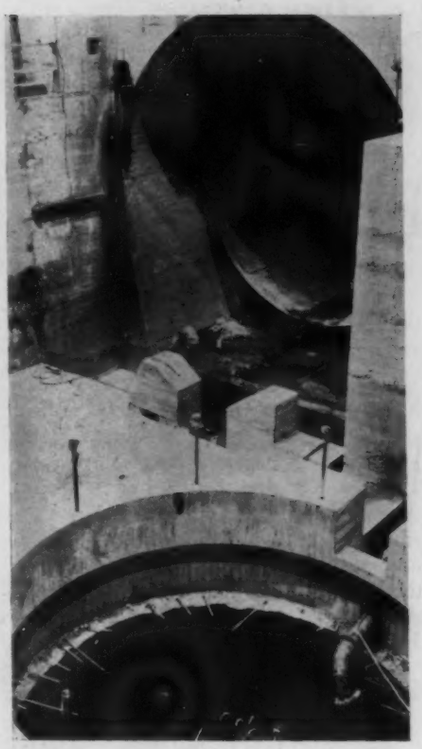
GRANDVIEW SUBSTATION, with capacity of 18,000 kva. to 12-kv. circuits and another 15,000 kva. to 4-kv. circuits, is the newest big addition to B. C. Electric's system. Striking in external appearance, its architecture is simple, yet unusually appropriate to the residential area in which it is located. Above center, A. Vilstrup (left), chief electrical engineer for B. C. Electric, is pointing out this feature to John Bankus (center), engineer, and Walter Brenton, chief engineer, both of the Portland General Electric.

Above left is the high-tension room, showing the 34.6-kv. oil circuit breakers, which are 3-phase enclosed in a single tank. Above right is the device developed by the company for lowering circuit-breaker tanks. It is tracked to and suspended from the I-beam, which runs the length of the row of breakers, thus allowing the one device to serve all breakers. Main-floor plan and a section through low-voltage structures appear below. All outgoing circuits are underground. Purpose of Grandview is to provide increased capacity, greater reliability, and better voltage regulation to an important metropolitan area. Existence of considerable industrial load along one waterfront section affected by the substation, plus residential loads, account for distribution at two voltages.

The reinforced-concrete building was begun a year ago, erection being by Northern Construction Co. and J. W. Stewart, Ltd. Electrical equipment was installed by B. C. Electric employees.

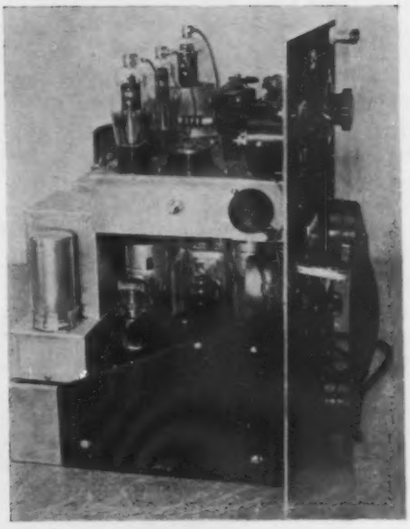
Coincident with the building of Grandview station were the conversion of distribution in Grandview district from 3-wire, 2,300-volt to 4-wire, 4,000-volt, and the laying of 12,000-volt underground, this voltage being used in ties to Main and Haro substations and in serving the large industrial loads

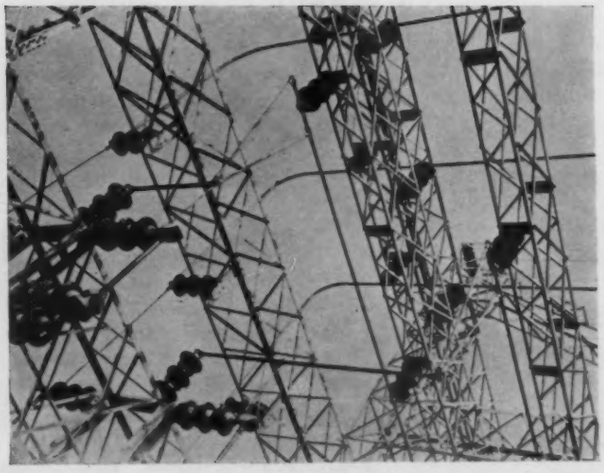




RUSKIN hydro plant of B. C. Electric Railway Co. is undergoing growth which will double its capacity—installation of a second 47,000-hp. unit. At left is the 19-ft. diam. steel penstock, visible at the lower end of the reinforced-concrete tunnel, as it appeared the first of the year, when this phase of the work was completed. At right is the present stage of construction. The scroll case of 1-in. plate has been completed, and the unit is ready for the placing of rotating parts. During construction, the first unit (identical with the second) is protected by a temporary wood housing. Dominion Engineering Works is installing the turbine, Canadian Westinghouse the generator

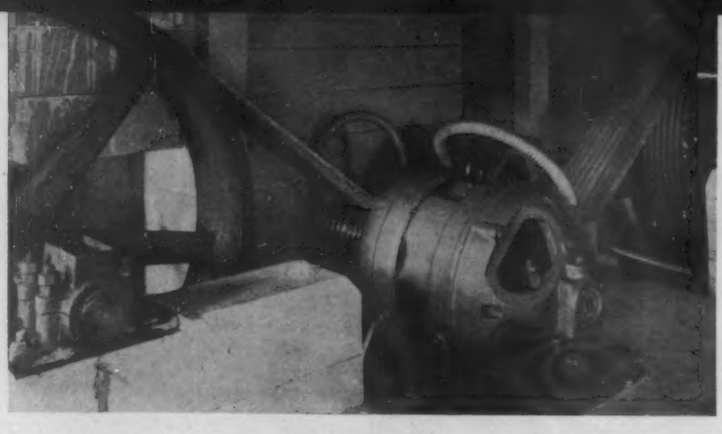
W7XDS and —T are the call letters on which Northwestern Electric Co. awaits only final approval to become the first Western utility to use two-way radio for emergency communication with field crews. At right center is one of the sets with which Northwestern has been experimenting, under license to operate at 3 watts, 31,600 and 35,600 kilocycles. Sets, combining transmitter and receiver, weigh about 40 lb. each, can be operated on 110 volts a.c., or 6 volts d.c., are furnished by Radio Specialty Mfg. Co., Portland





BONNEVILLE powerhouse is now topped with steelwork (above), buswork and installation of breakers and other equipment is nearing completion. Testing of main units has proceeded apace. These, rated 70 r.p.m., have been run in excess of 200 r.p.m. G. E.'s spring-supported thrust bearings, designed for working loads exceeding 2,800,000 lb., 50-percent larger than any previously built, apparently functioned to perfection. Main generators, rated 43,200-kw. each, were overloaded to 55,000 kw. Present program contemplates immediate installation of two more units, each rated 52,000 kw. Recent studies of water rate have led to specifying the larger capacity for future units

NORTHWESTERN Electric Co. made its first use of 3-phase transformers in street vaults this spring. Additional capacity was required for the company's 11,000-volt network, and an existing 2,400-volt vault was used. On account of obstructions, it was impossible to change the dimensions of the vault except in depth. Therefore, the floor was lowered 2 ft. and the neck enlarged to admit the 3-phase transformers in place of two single-phase banks which ordinarily would have been employed. At right one of the units is being lowered into the vault. It is rated 450-kva., 11,000/120-208-volt. Rubber-covered secondary cable replaced the old-type lead-covered cable on this job



High ratios and very short centers are permissible

By WARREN C. WEBB
Pacific Coast Representative
Dayton Rubber Mfg. Co.
Industrial Division

V-Belt Drives

Their Use in Power Transmission—the First of Two Articles

FROM fractional horsepower drives on household equipment to drives of 1,000 hp. in heavy industries, V-belts have widespread use for power transmission. In many cases they have solved major problems for the designer of new machinery as well as for the man in charge of power transmission in thousands upon thousands of industrial plants.

Industrially, V-belt drives are used extensively. For example: In the food industry the inherent cleanliness of the drive has been an important factor in its success. In the ceramic, cement and mining industries the compactness of V-belts, their ruggedness and their ability to withstand dirt, dust and moisture have a special appeal to power transmission engineers. (Fig. 1.)

Even in buildings—and there is a tremendous amount of machinery in the modern building—V-belts have solved a "transmission noise" problem. Transmission noise has a peculiarity of being readily carried through the framework of the building or through ventilating ducts. The quiet operation of V-belts helps prevent such noise.

Thus, V-belts for power transmission are playing a mighty important role everywhere because minimum space is required—smaller pulleys can be utilized and much shorter center-to-center distances are possible without the use of idlers. Equally important is their positive speed, which is maintained through greater gripping power. Because of their ruggedness they are not affected by dust- or moisture-laden atmospheres. Because they absorb the shock of power suddenly applied through "seating" action of the belts in the grooves of the pulley, they assure smooth starting and smooth running. They eliminate the vibration between the driving and driven machines. They permit less tension and are easy on bearings. (Fig. 2.)

In the correctly designed V-belt long life is assured and frequent take-up is unnecessary. The V-belt requires no lubrication, no dressing and does not leak grease or collect dust. Maintenance expense is, therefore, cut to the minimum.

Sizes and Determining Proper Length

On existing equipment using V-belt drives, the size of the belt is usually determined by a number such as 1B15. The reason for such a numbering system is this: V-belts are made in five standard cross-sections, A, B, C, D and E, "A" being the smallest size belt in cross-section and "E" the largest cross-section. Likewise, each cross-section is made in a variety of standard lengths. Thus each belt number is a combination of the cross-section letter and the belt length (usually outside in inches). For example, a belt 115 in. long in the "B" cross-section would be known, as 1B15; the same belt in "A" cross-section would be known as 1A15. In most cases the belt length and cross-section can always be identified immediately from the size number.

The belts in the larger cross-sections are normally used for the larger machines, while the belts of the smaller cross-sections are used for the smaller machines. Likewise, manufacturers have today standardized their pulleys so that proper combinations of standard belts and standard pulleys are available to meet practically any condition.

Driving a crusher in a cement plant

In calculating the average new installation of a V-belt drive, all that is necessary to know is the horsepower, the motor speed, the machine speed and the distance desired between the shafts. However, today the manufacturers of V-belts have complete drive tables contained as part of their catalogs. For example, catalog No. 180 of the Dayton Rubber Mfg. Co., manufacturer of Dayton Cog-Belt Drives, tells the proper drive at a glance without calculations when the above factors are known.

Overload and Peak Load

Average load conditions are those where the starting torque is equal to or less than full load torque and frequent peak loads are not encountered. For conditions more severe than average the number of belts should be increased.

Where the starting torques or peak loads are greater than 100 per cent but not over 150 per cent of full load value, use approximately 25 per cent more belts. Where the starting torques or peak loads are greater than 150 per cent but not over 200 per cent of full load value, use approximately 40 per cent more belts.

Reversing applications, such as cranes, hoists, etc., require approximately 25 per cent more belts.

Textile machines, such as spinning frames, usually require 40 to 50 per cent more belts. For line start motor application where the motor is started on full loading, use approximately 20 per cent more belts.

It is impossible to list all of the applications in the various industries that will require an increase in the number of belts, but as a general rule, the foregoing corrections will apply. The use of an increased number of belts for severe operating conditions, such as outlined, will prevent slippage when starting or under excessive peak-loads and will materially increase the life of the belts.

Cooperative Ad

Portland dealers tell why you should deal with them

Neighborhood appliance dealers in Portland, in connection with the spring showing of electric ranges, recently ran a cooperative ad telling why prospects could purchase from them to best advantage. Three reasons were:

"(1) You can view the new models most conveniently, save time and buy at the same prices and same easy terms as are available anywhere. (2) Your neighborhood dealer is in a position to arrange immediate installation for you. (3) Back of your range stands a man you know—a neighbor who makes it his business to see that your purchase renders perfect service. Get this 'plus' value with your range at no extra cost."

Participating were Alberta Furniture Co., Black-Frost Radio Service, Calef Furniture Co., Shaw Furniture Co., Hunter Radio & Appliance Co., Cohn Bros. Home Furnishers, M. J. Murdock Co. and Star Electric Co.

●

Future Campaigns

Various Rocky Mountains events scheduled for June and July

Following utility-dealer activities have been scheduled by Rocky Mountain organizations for June and July:

Colorado Central Power Co., Golden, Colo.—June, range and refrigerator campaigns. July, roasters.

Home Gas & Electric Co., Greeley, Colo.—June, water heater and range campaigns. July, ranges.

LaVeta (Colo.) Light, Heat & Power Co.—June and July, refrigerator campaigns.

Mountain States Power Co., Casper, Wyo.—June and July (in cooperation with local league), range, refrigeration and adequate wiring campaigns.

Mesilla Valley Electric Co., Las Cruces, N. Mex.—June, refrigeration and air conditioning campaigns; promotion and exhibits of evaporator coolers. July, range and water heater campaigns.

New Mexico Power Co., Santa Fe—June and July, adequate wiring, range, refrigeration, IES lamp and small appliance campaigns.

New Mexico Public Utilities Corp., Gallup—June and July, adequate wiring campaign.

Public Service Co. of Colorado—June, IES lamps and laundry equipment campaigns. July, refrigeration, IES lamps and air conditioning. Public Service Co., Salida, Colo.—June and July, range and refrigerator campaigns. Public Service Co., Grand Junction, Colo.—June and July, refrigerator, roaster and small appliances campaigns. Public Service Co., Brighton, Colo.—June, water heater and range campaigns. July, ranges.

Rawlins (Wyo.) Electric Co.—June, range campaign backed up by newspaper advertising and possibly a range school or demonstration. July, ranges and refrigerators.

Sheridan County (Wyo.) Electric Co.—June, ironer campaign. July, small appliances.

Southern Colorado Power Co., Pueblo—June and July, range, water heater and refrigerator campaigns.

Southwestern Public Service Co., Carlsbad, N. Mex.—June and July, iron, small appliances and flood lamp campaigns. Southwestern Co., Roswell, N. Mex.—June and July, adequate wiring, refrigeration and small appliances campaigns.

Utah Power & Light Co., Green River, Wyo.—June, range, water heater and iron campaigns. July, range, refrigerator, ironer and small appliances campaigns. Utah Power & Light Co., Evanston, Wyo.—June, range and hotplate campaigns; cooking school. July, water heater, hotplate and roaster campaigns.

Western Colorado Power Co., Montrose, Colo.—June, water heater campaign.

Western Public Service Co., Laramie, Wyo., and Las Animas, Colo.—June and July, range and refrigerator campaigns.

●

Sales Shorts

Little bits about recent and future merchandising activities

OVER 100,000 PERSONS paid 40c each to attend the eleven-day Southern California Home Show which ended May 1. According to Mrs. Stella Barclay of the kitchen planning section, Los Angeles Bureau of Power & Light, "During the first three days we received as many requests for kitchen plans as we obtained during the eight days of the Food & Household Show last November. This comparison shows there is more interest in electric kitchens today." The bureau display occupied 1,350 sq. ft. and consisted of four complete electric kitchens.

●

FOUR SACRAMENTO APPLIANCE dealers —Breuner's, Federal, K. O. Stout and Hale Bros. Appliances—held a two weeks' contest offering a Norge refrigerator to the winner of a 25-word statement on the best reason for owning a Norge. Space on the entry blank was left for the name and age of appliances owned by the contestant.

●

ELECTRIC HOME & FARM AUTHORITY has closed with Mountain States Power Co. a contract providing for cooperation in the financing of the sale of electrical appliances for use by consumers located on the utility's power lines in its Willamette and Tillamook divisions.

●

MUCH TO HIS SURPRISE, H. C. Bender, in charge of Washington Water Power Co.'s cooperative activities, last month read in ELECTRICAL WEST that the new Reddy Kilowatt home he designed for himself belonged not to him but to J. A. Halstead, manager of the Spokane Better Housing Committee. For so rudely and erroneously dispossessing Mr. Bender, the editors offer apologies.

●

NATIONAL WASHER-IRONER WEEK has been set for Oct. 23-29 by the American Washing Machine Manufacturers' Assn.

Refrigerator Talking Point

Floods melted down the adobe walls of many a Fresno Fig Garden district home, but the electric refrigerators stood their ground through it all. This one was built into a kitchen. Note the high water mark

PACIFIC GAS AND ELECTRIC CO. is allowing up to $50 for wiring when a customer in the company's electric territory turns in a coal, wood, oil or tank-gas stove on a combination purchase of an electric range and water heater.

●

NORTHWESTERN ELECTRIC CO. is cooperating with all territorial range dealers taking orders among their customers for closed elements to replace the open type elements for those damaged beyond repair.

●

SEATTLE CITY LIGHT recently advertised a special of an electric range installed complete, including all wiring, with an old range in trade, for $79.50.

●

ADVERTISING DURING the past month in many sections of the West indicated a general clearance of merchandise at sacrifice prices. Many of the standard lines were slashed in special offers.

●

MORE THAN 10,300 certified IES better sight lamps were sold in Washington Water Power Co.'s territory during the recent 6-month light conditioning sales program. The figure tops all previous records.

●

TO CONTINUE THROUGH JUNE are home service cooking schools inaugurated at the recent meeting of Washington Water Power Co.'s home service advisors.

●

CASPER, WYO., electrical contractors have unanimously affiliated themselves with the Rocky Mountain Electrical League.

"HOME BUILDERS' IDEA BOOK," a 90-page booklet covering the subjects of wiring, lighting, the kitchen, heating and water heating, has been issued by Pacific Gas and Electric Co. Completed after a year's preparation, the book is to be presented to customers by Red Seal wiring salesmen or upon application.

●

PHOENIX (ARIZ.) RADIO & SUPPLY CO. recently advertised an offer of a scientifically planned visual drawing of an electric kitchen designed for the prospect's needs.

●

AS PART OF ITS DEALER sales promotion program, Montana Power Co. has inaugurated a series of dealer cooking classes. First were held in Butte under the direction of Mrs. Ethel Sales, company home service advisor.

●

ELECTRIC APPLIANCE SOCIETY of Fresno Calif., recently conducted a spring showing of electric ranges in which all appliance dealers of the region participated. The showing was tied in with the national event.

HOT STUFF

—by Russell

"Right or wrong, that roaster gives him the only hot lunch on the job."

PORTLAND GENERAL ELECTRIC CO. is conducting another of its electric range slogan contests. A $100 prize is offered as credit on a purchase of any 1938 range.

SALT LAKE CITY coal dealers combined to advertise the installation of electrically controlled coal stokers in a tie-in with the FHA's local publicity and home modernization drive.

APPLIANCE SALES REPORT

A Summary of Dealer and Utility Reports Compiled by Associations, Societies, Bureaus, or Dealer Contact Departments of Utilities

APRIL, 1938

Reporting Companies	Idaho Power Co.[1]		L. A. Bureau of P. & Lt.[2]		Montana Power Co.[3]		P. G. & E. Co.[4]		San Diego Cons. G. & E. Corp.[5]		San Joaquin Lt. & P. Corp.[6]		Southern Calif. Edison Co. Ltd.[7]		Utah Power & Lt. Co.[8]		Wash. Water Power Co.[9]	
	Current	4 Mos.	Current	4 Mos.	‡Current	‡3 Mos.	*Current	3 Mos.	Current	4 Mos.	Current	4 Mos.	Current	4 Mos.	‡Current	‡3 Mos.	Current	4 Mos.
Ranges	409	1094	387	1504	114	212	252	654	40	155	102	455	270	1070	231	621	229	597
Water Heaters	226	406	95	485	14	31	185	415	40	150	45	197	105	402	40	73	162	367
Air Heaters, aux.	16	166	47	435			355	2174	45	545	9	114	67	672	52	317	62	371
Air Heaters, 220			23	143			47	185			20	146						
Refrigerators	531	1194	3300	8409	458	790	2898	6275	750	1975	738	1622	4357	9824	479	1062	784	1729
Dishwashers	2	3	10	55			17	31			6	33			9	12	1	3
Washers	292	1325	1722	6004	510	1013	2968	5829	300	1225	288	1056	2125	7497	777	2024	329	1573
Ironers	18	156	331	1103	78	138	362	1032	50	200	53	185	280	1067	50	123	41	127
Vacuum Cleaners	111	374	556	1984	397	697	2131	5563	200	845	108	410	1104	3524	675	1188	195	715
Radios	404	2719	2697	10066	698	1962	8113	24560	800	3700	452	2220	4069	16577	1111	4153	870	4004
Mixers	30	184	147	582			277	818	135	435	39	140	221	930	102	537	90	431
Cookers, Casseroles	11	54	67	291					70	270	32	104	63	259	159	265	258	865
Irons	285	1355	564	2222					475	1675	272	1029	949	3746	797	2585	654	2403
Waffle Irons	76	457	241	856					150	625	57	312	286	1305	272	919	176	681
Toasters	106	614							300	1250	160	485	415	1923	398	1298	334	1332
Table Stoves	65	330	132	691	1364	2657			60	255	71	305	211	991	487	1677	77	581
Heating Pads	29	229	101	677					75	525	30	185	131	878	161	739	100	542
Curling Irons													44	162	142	624		
Coffee Makers	140	637	25	199					325	1140	80	438	265	1201	401	1246	409	1548
Sewing Machines	8	39					530	1740	80	320					174	445	58	227
Clocks	66	328	174	743					250	1175	157	629	515	2111	183	757	310	829
Fans	16	33	51	167	48	99					21	26	57	200	15	40	42	115
Floor Polishers																		
Sun Lamps	6	44	24	103									31	119	16	41	6	22
Reflector Lamps	282	1273			559	1718					72	440			754	2538	1282	6010
Miscellaneous Lamps	90	708									60	510			533	1974	790	2792
Yard Lights											44	139			28	72		
Misc. Small Appl.			357	1779					500	2450	117	429	645	2478				

SOURCES

[1] Figures compiled by Electric Equipment Sales Association. Include power company sales of all reporting dealers—about 60%

[2] Compiled by Los Angeles Bureau of Power and Light for territory served by that system.

[3] Combined dealer and company sales from report of Montana Power Co.

[4] P. G. & E. reports sales of major appliances only based on accurate reports from dealers' accounts. Ranges, water heaters and air heaters include company and dealer sales. *Lag of current and total figures is always one month greater than those figures of companies reported in other columns of this table.

[5] Gathered by Bureau of Radio and Electric Appliances of San Diego County. Estimated monthly sales figures used in this table: Miscellaneous figures includes fans, curling irons and sun lamps.

[6] Includes dealer reports from Midland Counties Public Service Corporation also. Compiled by Valley Electrical Supply Company.

[7] Includes reports from dealers on San Joaqin Valley system of company as well as Southern California areas served.

[8] Includes Utah Power & Light Company territory in Utah, Idaho and Wyoming. Also Western Colorado Power Company territory.

[9] Dealer sales only for Spokane and company territory. Company sales not included. Table stoves, grills included with cookers.

‡ April report was not received at time of going to press.

ELECTRICAL WEST

Appliance Sales Guide

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Reach Rich and Poor with Electric Roasters

An Idea—Maybe an Answer to your need

WHERE GET DEMONSTRATORS? Factory or distributor trained women are best, of course, and can be had on special arrangement with your distributor. But it is best to provide yourself with a local demonstrator whom you can employ for a few hours daily for more days. Either train some local woman who is a good cook, and has used a roaster, to give informal demonstrations in the store, or perhaps your wife, sister, or mother can handle a roaster well enough to demonstrate it every day. When the expert from the factory is available, make a special advertised event of it.

WHAT TO COOK?—For everyday demonstrations select simple home cooking. Show the roaster doing the kind of job it would be called on to do everyday in an average family. Avoid the fancy cakes and dishes that look nice but that few women would cook more than rarely. Roasts and oven dinners make good demonstrations for special occasions, but for everyday demonstrations biscuits or cookies are quickest, can be made in small batches from prepared flours as they are consumed by prospects, and represent the least demonstration cost.

KNOW THE ANSWERS—Store prospects who stop to watch a demonstration, taste the biscuits, will ask a multitude of questions to satisfy their own minds that the roaster will do the cooking they have in mind for themselves. Until all their doubts are removed no sale is made. Anticipate such questions by being prepared to answer any query anyone might make. Your sureness of answer will go a long way toward giving the prospect confidence. Often the prospect sells herself by questions. Encourage them. It makes your selling easier by giving you an opportunity to answer with the advantages to be gained by purchasing.

WORKING WOMEN—An idea worth using over and over, for it makes sales every time, is that of sending invitations to a number of women who work in offices or stores to have lunch at your store at a specified time. Cook the entire meal in roasters and as they enjoy the meal, tell the group in a friendly way how the use of a roaster by them will solve one of their main problems, cooking for themselves and possibly their children while they work. Tell also how the roaster can make picnics a relaxation for them, and vacation an inexpensive one with the cooking problem half solved by an automatic roaster.

WEEKLY PAY PLANS are useful in selling roasters to people of small income. These people form one of the largest markets and are well worth cultivating.

WHERE and to whom should the effort be directed to make the most sales of electric roasters? Besides the casual store trade, made up mostly of home makers, what specific markets are worth a more direct selling effort?

Summer cottage owners are the ripest sort of prospects. The roaster is just the answer to their desire to spend as much time outdoors at play and as little as absolutely necessary indoors preparing meals. Get a list of such cottage owners from real estate tract maps, Forest Service allotment maps, or any other source. If these are not available, circulate your advertising literature or letters among the upper middle class residential districts and you will not miss many of them—the others reached will also be suggestable to buying a roaster for picnics and vacations.

Tea rooms and small restaurants are excellent prospects for roasters. The roasters permit them to serve hot foods from the dining room, or from a tea wagon, continental style, direct to the tables. They are attractive in appearance and make the serving of women guests more graceful and pleasant. Quantities ample for most tea rooms can be prepared and kept warm during the meal period. Stress these advantages when soliciting this business.

Maternity homes and *small hospitals* are good prospects. Roasters provide the advantage of expensive portable steam table service to many institutions which could not afford the heavy equipment. Attractive roasters give a homey touch that should aid the appetites of sick patients. Tell these features in selling such hospitals.

Doctors and dentists can use a roaster for sterilizing instruments. Of course the well equipped city doctor will have the professional equipment, but many a country doctor could use one. Tell him he can even take one along with him for home cases and have a means of sterilizing his instruments.

Employers of women who have lunchrooms in which the women employees prepare their own lunches can provide an easily-kept-clean method of cooking for them. A fine gesture of goodwill and an insurance of afternoon efficiency because of well cooked lunches.

School domestic science departments and cafeterias can use roasters to good advantage. Sell one to the teachers for their luncheon room.

Food demonstrators working in grocery stores can use roasters to demonstrate prepared cake flours, biscuits, toasted cheese dainties, and other delicacies.

Unusual, but logical, prospects are *small barber shops*, to sterilize brushes and combs; *small laboratories* for the heating of cultures, sterilizing, etc.; *golf* or other *clubs*, for serving of meals out of doors; *hotels*, for serving meals to rooms in an attractive home-like manner.

June 1938

Electric Roasters

...When the

Hardly ever——

Seldom does a salesman or saleswoman get an absolute "No" in presenting an electric roaster if he or she has taken the time to demonstrate it completely and to tell the prospect the advantages that the possession and use of one of these modern appliances will bring. (A list of these advantages is to be found in the next column). A thorough demonstration answers most of the questions anyone might have concerning the roaster—what it will do, how well it does it. When a full demonstration is not possible the word picture of the benefits to be enjoyed from an electric roaster will sell all but the most obstinate cases.

Once in a while you may run into one of the following conditions: You may uncover such resistances during the course of a demonstration, or while you are explaining the roaster and what it will do. From some of the more reserved and untalkative prospects you may find that your asking for the order fails to get a response and brings a short and unexplained "No." Then by a few judicious questions you may find one of the following to be the reason for not buying:

1. Can't afford it, or think it costs too much.
2. Has a good range and oven now.
3. "It is too small for my family."
4. Wouldn't get enough use out of it.
5. "Doesn't it stew rather than roast?"
6. Has no place to store it.

To isolate the cause for resistance is almost half the battle. It is easier then to apply to it the particular advantage points that are most effective in answering that objection. By concentrating on these the way is sooner cleared of the obstacle and the salesman can ask for the order again. This may bring out another resistance, but again it can be handled in the same way until all of the resistances have been eliminated. Often a prospect just wants to be reassured on the points she brings up as resistances and when you can give her the assurance that the appliance will answer the need that she expresses she will buy with a sense of relief because all along she wanted the appliance but needed the backing of good reasons to justify its purchase.

In brief the advantages you can assure are:

1. **A cool way to cook in summer,** for all heat remains in the roaster, just as in a well insulated electric oven.

2. **Deliciously cooked meals.** The same flavor-saving, same juice and mineral retaining waterless cooking possible on an electric range; the same penetrating heat that makes tough meats tender.

3. **Take it anywhere.** Gives summer freedom from the kitchen. Prepare a meal, cook it, carry it in the car on picnics, to summer vacation, to the church social with hot delicious foods, anywhere.

4. **Free from attention.** Automatic controls permit you to go out and leave it cooking. On vacations it cooks while you enjoy outdoor play. Simple enough that children can operate. Peace of mind comes from its safe efficiency.

5. **Space saving.** An appliance that does so many cooking tasks, ideal for small apartments and housekeeping rooms. Serve right from the table, where it can be kept. It is attractive and need not be kept out of sight. No need to leave your guests while serving. Keeps second helpings warm.

6. **Saves time and effort.** So easy to prepare and load ready to cook. Cooks entire meal in one operation. No pot watching or basting needed.

7. **Easy to keep clean.** Both the exterior finish and cooking inserts and racks are as easy to clean as a dish. Inner shell is removable for washing. No soot or smoke, and no need to burn foods when heat is under automatic control. Kitchen walls and drapes kept clean of greasy fumes too.

8. **Economical to operate.** Costs less than 2 cents a meal at low Western utility rates. Saves 10 to 20 per cent meat shrinkage. Cooks entire meal at once, more than half the time on stored heat. Thermostats economize for you.

9. **Useful in so many ways.** Besides baking, boiling, roasting, grilling, frying, stewing, it can be used in canning, deep frying—keeping grease just the right temperature. It can be used to keep things cold too. When someone is sick it can be useful in many ways.

ROCKY MOUNTAIN ELECTRICAL LEAGUE • PORTLAND GENERAL ELECTRIC CO.
CALIFORNIA OREGON POWER CO. • WASHINGTON WATER POWER CO.

Prospect Says: "NO"

NO. 6B
ELECTRIC ROASTERS

Combine ADVANTAGES to answer OBJECTIONS in this way—

1. Can't afford it, or costs too much.
"Yes, I can certainly appreciate that sentiment these days. All of us make our money go farther in every way possible. That's why I feel that an automatic electric roaster offers you one of the best ways to beat the high cost of living that this electrical industry has produced. Just think, in this one device you have so many varied services (tell them) all included in one appliance, with a thermostatic watchman to help you to economize on the cost of fuel. By cooking entire meals in it more than half of the time you will be cooking on stored heat. You will save from 10 to 20 per cent on shrinkage of meats. And with the terms we can arrange for you, you can make the roaster pay for itself as you are using it. In a case like this, you can hardly afford not to have one, can you? Why not enjoy one right away?"

2. "You have a good range and oven?"
That must be a real treat. Many of my customers do not. Then you can appreciate how much a good oven contributes to excellent results. Haven't you often wished you could take such an oven with you on vacation or on a picnic to have hot delicious food just as though you were right at home? Then, too, there may be times when you are entertaining and need an extra oven at home, perhaps to cook something at a different temperature than what you already have in the oven. An automatic roaster like this comes to the rescue in just such emergencies as that. And besides it is useful in so many other ways.—" (go on and tell them and ask for the order.)

3. "Too small for your family?
Well, I can see that you would want to be sure on that score. I would like to sell you two of these excellent roasters, and possibly later after you have used this one a while and found how much it can save your time and energy—and that is so important with a big family, isn't it—you may want another. Why not start with this largest model here and by reading the recipe book carefully and planning the use of the roaster you should be able to cook many things in sufficient quantity. Many of my customers cook entire meals for church socials sometimes with one or two roasters. Would you like to try one in this way and then you can judge better if you will need the other right away?"

4. "Wouldn't get enough use out of it?
I know how you feel, and it is wise of you to question this point. I am sure that right now, without having used one and had an opportunity to tests its versatility it might seem as though you would get little use from an automatic electric roaster, but once you begin to enjoy the freedom from a hot kitchen it gives you in summer, the opportunity to take warm and appetizing foods with you on picnics, you will begin to realize its possibilities. You will want to take it with you on your vacation so that you can enjoy more time at swimming and play and spend less in cooking the meals. Then, too, in emergencies it is remarkable how useful this appliance can be. When someone is ill, it can be used to serve them hot foods, sterilize dishes and prepare hot or cold compresses. When you consider all these, don't you feel that it could be as useful to you, too?"

5. "Stew, rather than roast?
I am glad that you have given me an opportunity to clear up an idea I am afraid a good many people have and which deprives them of the enjoyment of one of these fine new automatic roasters. Possibly the idea originated with the old fireless cookers, which often did stew rather than bake. But those depended on the heat stored up in a brick whereas the heating element of these modern electric roasters is so distributed as to bring the heat in from all sides and the bottom, to maintain just the right cooking temperature, and to cut off the current automatically to maintain the heat. They are also furnished with enough electricity to heat quickly and at high enough temperatures to broil or roast perfectly."

6. "No place to store it?
That is a problem. I know. Let's see if this roaster itself will not solve or help to solve that problem for you. Many of my customers tell me they never store it: but keep it always on the breakfast room table or sink board where it can be used most conveniently every day. They find that its insert pans are always in use, and that they can eliminate many other pots and pans they found necessary before. You will find that in this one appliance you combine so many services that take lots of other equipment to handle—why not try to see if you cannot save yourself housework by getting one of these roasters and eliminate older methods?"

Publicity for Roasters

Savory odors of deliciously cooked foods issuing from a roaster during a demonstration make the best method of attracting prospects. For store traffic, or passersby on the street, keep an active demonstration going. Arrange to have your wife, mother or some local woman who is a good cook make daily demonstrations or give cooking hints. Advertise these demonstrations and the roasters will sell those who come to see. Between advertised demonstrations it is a good idea to keep a roll of ice box cookies in the refrigerator and a roaster on low heat ready for a quick demonstration while you describe the sales features with another roaster. By the time you finish with the story the cookies you put in at the start of your presentation will be cooked and taste delicious. Asking for the order should be easy when taste backs up your sales story.

To Write Simple Letters

With the advantages of electric roasters listed inside this Guide the writing of appealing sales letters is much simplified. A friendly short letter giving one or two of the advantages of using a roaster, as the suggested letter at the right does, will bring a large percentage of responses. A follow-up letter with a few more of the advantages—not the mechanical details—will pull more. the third and fourth letters will draw increasing results, and direct mail experts say that the fifth letter usually pulls the best results. Most failures in the use of direct mail come from lack of appeals, neglect to tell of *advantages* to users, and from stopping toe soon.

Date

Mrs. N. E. Smith,
1234 Every St.,
Yourtown

Dear Mrs. Smith

Warm weather will soon be here and then some way to cook and still keep cool will prove a blessing, won't it? I'd like to have you see what a great many of my customers found was the best summer idea they ever had. They found a way last year to keep the kitchen 10 degrees cooler by doing a lot of their summer cooking with an electric roaster.

Besides, they found it gave them summer freedom from the kitchen. They could prepare a meal, cook it, carry it away in the car on a picnic, to summer vacation spots, to church socials and garden parties, and have delicious hot foods.

Drop in next time you are by the store and I will be delighted to show you just how one of these new automatic roasters can make your summer the pleasantest you ever had. I really mean it.

Yours for summer coolness,

(Signature)

Keep Cabbage Odors Outside

Everybody loves cabbage, but nobody loves the odor with which it usually fills the house. You may not be able to move your kitchen range outside to cook cabbage, but you can put the automatic electric roaster out on the back porch and let it cook the cabbage to delicious flavor without "smelling up the house," as folks say.

This idea of a portable oven is a mighty useful one, anyway you look at it. It enables you to take a nice warm lunch out on a picnic, or to save yourself lots of summer cooking worries when you take it on vacation with you. It has more uses than you can imagine.

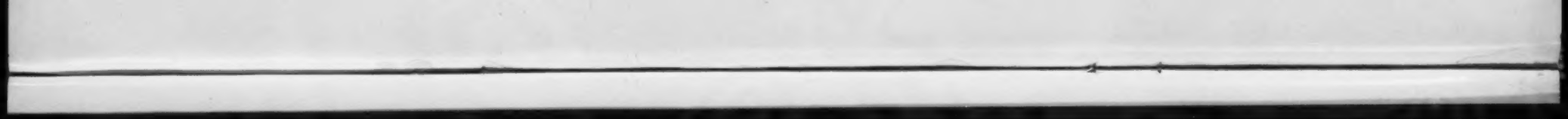
Drop in and let us tell you a few more, taste a sample of its cooking, and convince yourself.

Your Store

Address
Town

Ads

Excellent product ads are available from the makers of your brand of roaster, either in matt form or in electros. Use these, of course. But if you want to attract attention by a more local, personal means, write some simple little ads of your own, using the advantage points listed inside in a manner similar to the suggested ad at the right. Select a single idea, then talk about how the roaster will solve a particular problem, in common everyday language. People respond to a human sort of ad.



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Northwest Electric Light and Power Association

1937-38

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Business Development Section*

Introductory Statement

THE Advisory Executive Council of the section met in Portland Aug. 20, 1937 to organize and lay plans for the year 1937-38. The organization included the Residential Sales Bureau with three committees, Commercial & Industrial Sales Bureau with three committees, the Rural Sales Bureau and the Advertising Committee.

On the invitation of Glen L. Jackson, The California Oregon Power Co., Medford was chosen as the place for the annual spring meeting of the section. The third annual Commercial Cooking Conference was authorized to be held under the sponsorship of the Commercial & Industrial Sales Bureau.

The Commercial Cooking Conference was held at the Benson Hotel, Portland, Nov. 4-6, 1937. Thirty-eight delegates from 13 utility companies, 16 delegates from seven manufacturing companies and two advertising agencies, and five miscellaneous attended, making a total of 69, or 18 more than last year. Four half day sessions of the programed discussions were held. The minutes of the meeting were mimeographed and distributed to delegates to the conference, member companies and others. Incidental expense of the meeting and the cost of producing the minutes was defrayed by a $2.00 registration fee charged to delegates.

The 13th Annual Meeting of the section was held at Medford, Ore., Mar. 16-18, 1938, with 194 delegates registered, 180 of whom were from outside of Medford. The delegates were housed in five hotels including the Lithia Springs at Ashland, Ore. The Medford Hotel was used as headquarters.

Like the Salt Lake meeting of the previous year, the meeting consisted in part of general sessions and in part of committee conferences running concurrently. The general sessions were held in the Holly Theater and the committee conference in the Masonic Temple. An innovation this year was the "Dog House," an entertainment room situated in the basement of the Medford Hotel and operated and financed by manufacturers and distributors.

The first general session Wednesday morning, Mar. 16, was called to order late by Ralph E. Gale, chairman, on account of the late arrival of the special train from Portland bringing most of the delegates. Glenn L. Jackson welcomed the delegates on behalf of The California Oregon Power Co. He was followed by welcoming addresses by the personal representative of the mayor of Medford and the president of the Chamber of Commerce. Responding on behalf of the Association, W. C. Mainwaring, President, took occasion to refer to some of the objectives of the meeting. An abstract of his remarks is published hereinafter.

Wednesday afternoon the meeting broke up into committee conferences as follows: Home Modernization Committee; Home Service and Home Lighting Committees; Commercial & Industrial Sales Bureau taking up commercial cooking and commercial and industrial lighting; Rural Sales Bureau; and Advertising Committee. The following morning the same groups met to continue and complete their committee programs. On that day, the Commercial & Industrial Sales Bureau took up commercial lighting and industrial power and heating.

Again assembling in general sessions on Thursday afternoon, Mar. 17, the conference heard reports from the Home Modernization Committee, by E. E. Walker, Chairman; Commercial Cooking Committee, by D. A. Runyard, Chairman; Home Service Committee, by Edith Rauch, Chairman; and the Advertising Committee, by M. L. Cummings, Chairman. In addition, D. B. Leonard, Pacific Power & Light Co., presented the subject originally assigned to L. A. McArthur of that company, "The Relation of Customers' Investments to Kw.-hr. Consumption." An abstract of this paper is published hereinafter. At the end of the session the Frigidaire sound film, "Selling America," was shown.

At the opening of the general session Friday morning, Mar. 18, the Vocafilm Corp. sound film entitled "Light on Power" was shown. Thereafter reports of the following committees were heard:

R. E. GALE and EBASCO'S MR. OLDS

Commercial & Industrial Lighting, by H. A. Olson, Chairman; Home Lighting, by Walter E. Potter, Chairman; Industrial Power & Heating, by E. C. Branch, Chairman; Rural Sales Bureau, by W. R. Newmeyer, Chairman. The Section meeting closed with an inspiring address entitled, "To Sell—Who, What, Why, How, Where, When?" by George C. Tenney, editor of Electrical West. An abstract of this address is published hereinafter.

Short airplane trips over the Rogue River Valley, as originally scheduled by The California Oregon Power Co., were not possible because of the weather. Further, severe weather conditions in the vicinity of Crater Lake made the scheduled trips to that point impossible. The trip to the Oregon Caves, however, was conducted on schedule Friday afternoon, and many took advantage of this opportunity. A stag smoker at the Medford Hotel was a feature of Thursday evening.

In the following pages are printed summary reports of the committees as well as extracts or abstracts of the several papers presented in the committee conferences. These are preceded by abstracts of the addresses of W. C. Mainwaring, D. B. Leonard and George C. Tenney.

BERKELEY H. SNOW

* Advisory Executive Council: Ralph E. Gale, Idaho Power Co., Chairman; W. A. Huckins, Utah Power & Light Co., Vice Chairman; Chairman, Commercial and Industrial Sales Bureau, A. H. Wegner, The Washington Water Power Co.; Chairman, Residential Sales Bureau, Henry Kruse, Puget Sound Power & Light Co.; Chairman, Rural Sales Bureau, W. R. Newmyer, Portland General Electric Co.; B. C. Electric Railway Co.: W. C. Mainwaring; The California Oregon Power Co.: Glenn L. Jackson; Grays Harbor Railway & Light Co.: H. G. Kelsey; The Montana Power Co.: I. L. Comstock; Northwestern Electric Co.: George H. Wisting; Pacific Power & Light Co.: D. B. Leonard; Portland General Electric Co.: A. C. McMicken; Puget Sound Power & Light Co.: Patrick Johnson; The Washington Water Power Co.: L. A. Lewis.

Response to Welcome

By W. C. MAINWARING*
B. C. Electric Railway Co.

TODAY there are many influences at work that prevent us from devoting our entire time and energy to the direct operation of our business. For that reason there is a greater need than ever before, through the medium of the Northwest Association, to keep our feet on the ground and not allow ourselves to become worried to the extent that the service we are organized to render will in any way be impaired. The chairman of our Business Development Section, Ralph Gale, mentioned that the paramount thing before us was constantly to improve customer service. There is no doubt in my mind that if we strive through every possible avenue continually to improve the service we are giving our customers that public opinion will be in our favor whenever we are attacked. And that type of loyalty from our customers is something that money cannot buy.

Just as we thought we were selling ourselves out of the depression we were faced with a recession, and now our job is to sell our way out of that. There is no industry in so favorable a position in this connection as the electric light and power industry. Our markets are virtually untouched. Although in the Northwest we enjoy the highest kw.-hr. consumption per residential customer of any place on the continent, we must not rest on our laurels. The homes we are serving are only using from 10 to 15 per cent of the potential amount of energy that will be used when they are completely electrified. We have, therefore, a very big job before us. One of my travelling companions on the train to Medford mentioned that a town in the State of Washington had reached an average of 3,700 kilowatts per residential customer, so you can see just what the possibilities are.

There is, consequently, a service to our customers that is yet unfulfilled. A service of more convenience, more happiness and more enjoyment as a result of the appliances the customer can use in connection with this service. It is not only our opportunity but it is definitely our duty to see that the public uses our electric service to the fullest extent.

This is an old association. It has served our industry for a great many years and has been a useful instrument for the interchange of ideas and methods and the discussions of policies. It will continue to be useful to the extent to which each member company supports it. Each one of us is charged with a direct responsibility to carry out our duties to the Association so that in turn it will render a better service to the public through the company with which we are employed.

At this time I want to pay tribute to Ralph Gale and the Committee Chairmen in the Business Development Section who have worked so hard in preparing a program that I know is going to be extremely interesting to all of us. The great value of this meeting will not lie so much in the papers that are presented but in the discussions that follow, and for that reason I bespeak your constant attendance and support throughout the next three days.

The registration for this meeting is approximately 200, and I want to thank Glenn Jackson and all of his associates who have looked after all local arrangements to make this meeting an outstanding one.

* An abstract.

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Investment and Consumption

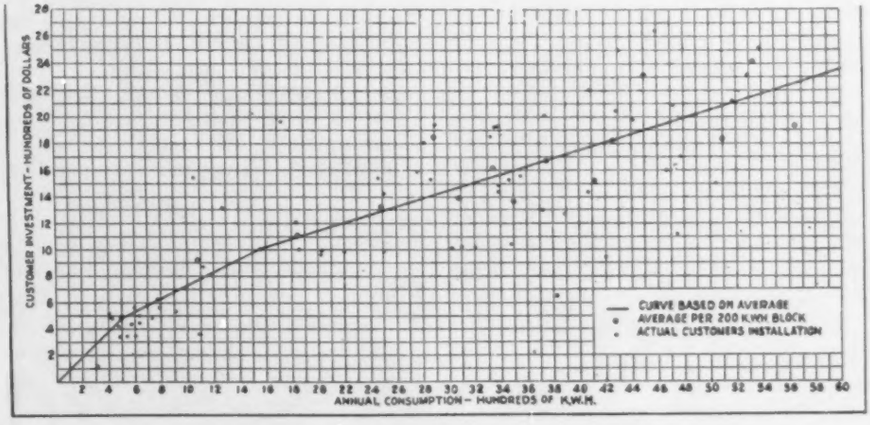
By L. A. McARTHUR
Pacific Power & Light Co.
Presented by D. B. LEONARD
Pacific Power & Light Co.

A FEW years ago our company became much interested in the relationship between customer investment in his own household equipment and the number of kw.-hr. he used in a year. In beginning our study of this relationship we proceeded to make an analysis of many typical residence installations and endeavored to get a diversity of customer types that would represent a cross-section of all customers. We made an accurate appraisal of the customer's original appliance investment, including house wiring but excluding two components: (1) the cost of an oil-burner furnace over and above the cost of its electrical equipment and (2) the cost of the boiler part of an electric water heater installation. All other electrical equipment and house wiring were included. We plotted each customer's investment in dollars at a point on a chart above his annual consumption and indicated as nearly as we could the mean for each one of these columns. We then struck on the chart a line curve indicating the results of connecting these mean positions. (See cut.)

The chart does not represent, and it is not intended to represent, any particular individual. It does not represent, and it is not intended to represent, any particular type of installation. It is a composite curve that will show (if the figures are correct, and I think they are) that, if the Pacific Power & Light Co. hopes to double the kw.-hr. consumption of its residence customers during the next five years, raising the figure from approximately 1,400 a year to 2,800 a year, then our customers must be prepared to invest approximately $500 a piece in current-consuming equipment in order to utilize this extra electrical energy over and above what they are now using.

By no stretch of the imagination can our customers who are now using an average of 1,400 kw.-hr. a year use 2,800 kw.-hr. a year unless they buy more equipment. It is true that there may be some slight increase in the use of the equipment that is now installed, but, after all, our customers cannot do very much more cooking than they now do and they cannot do very much more

Relation between residence customers' investment (appliances and wiring) and annual kw.-hr. consumption for Pacific Power & Light Co.


CUSTOMER INVESTMENT—HUNDREDS OF DOLLARS
ANNUAL CONSUMPTION—HUNDREDS OF K.W.H.
CURVE BASED ON AVERAGE
AVERAGE PER 200 K.WH BLOCK
ACTUAL CUSTOMERS INSTALLATION

washing than they now do on the electric ranges and washing machines they have on their premises. They cannot do a great deal more lighting with their present equipment. More equipment is the only answer.

If our 41,000 customers are going to double their present uses, according to our estimates they will be required to invest $500 apiece for new equipment. That is going to require the sum of about $20,000,000 to buy electrical equipment. This figure may be discounted, but even at a substantial discount the total will be large. Customers' money must be available to buy this merchandise.

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To Sell

Who—What—Why—How—When—Where?

By GEORGE C. TENNEY*
Editor, Electrical West

In his presentation the speaker used a hidden voice—Bottle, the radio ghost — which interrupted and commented in various parts of his speech. The same effect is carried out in the following text.

Our primary interest is to sell.

B: Who?

The American public

B: What?

All possible applications of electricity it can beneficially use and economically afford

B: Why?

To provide it with comfort, leisure and the more abundant life

B: How?

By utilizing every proven and effective sales tool

B: Where?

In every corner of the market place —home, store, factory and farm

B: When?

At every opportunity.

There is no gainsaying that our industry has done and is doing a good job in accomplishing this primary sales task. For proof one needs only to analyze the sales statistics with which every one of you are familiar. However, despite this excellent sales job, something has been lacking. Otherwise our standing with the public would be better than surveys such as those conducted by "Fortune" magazine and other agencies reveal it to be. One such survey might be quoted for proof. A national advertising agency investigating the public's attitude toward big business asked 1800 people from all walks of life what corporations in their opinion, fooled the public. You can guess who topped the list.

B: I know.

Who was it?

B: Twelve per cent thought the public utilities were the worst offenders.

Right, and the utilities ranked 2½ times worse than the financial houses and eight times worse than the chain stores.

Doesn't this seem to indicate that there is an intangible something lacking in our sales approach or sales technique? Certainly it would seem that if our salesmanship measured up in every respect, then our standing with the public would be higher than those surveys indicate.

Some element seems to be missing. My personal feeling is that it is lack of coordination rather than any failure in setting up ideals and objectives.

Perhaps if we examine further the findings in the survey referred to a few moments ago, we may find a clue. In analyzing the reactions of the public toward big business as disclosed in this survey, several conclusions were reached. Those having a bearing on our problem were as follows:

1. Most people don't get sore at large corporations unless someone stirs them up.

B: They certainly have been using some large spoons to excite the public about the electrical industry.

2. Because people buy a corporation's goods, it doesn't follow that they like the corporation.

B: Yeah. Ivy Lee says "Publicity and public relations people will never be able to make people love a corporation —nobody is going to love anything whose sole object is to sell them something. You can't make people love an impersonal thing whose business is to make money out of them."

3. The better known the corporation, the harsher the censure and the greater the praise.

B: Your electrical industry must be well known then.

4. Internal relations with employees are as important as external relations with the public. Education begins at home.

B: I think you've got something there.

Bottle is probably right. In my humble opinion our trouble is internal. By that I do not mean that it is inside someone else, but inside of each and every one of us—me, you, you and you. We need some spiritual revivification of the Baptist revival meeting kind. We need a strong shot of business religion. Until we are sold on our business and on our jobs, we can't expect to launch any kind of a drive to change public opinion.

Sometimes we forget that we ourselves are the public, that our fellow employees are a cross section of the public. Perhaps we should analyze how we feel and find out how they feel about the business. I think that if every man and woman in this business believed sincerely that our product, prices and policies were right, then a major portion of our job would be finished. Our own people are more than just a point of contact with the public—they are experts about our industry. If they do not think that things are right, the public will be halfway sure that they aren't.

Not long ago in a gathering of business people, the statement was made that the electrical industry had lost the position of leadership which it held a decade ago. The speaker pointed out how industrial electrification had brought the country out of one depression, how radio had helped pull us out of another and how the refrigerator had given general business a needed shot in the arm at a psychological moment. Those were contributions to real prosperity and to economic security, he pointed out. Then he asked what we were going to do to reassert our leadership.

In my humble opinion the time has arrived for us to stop wondering about what is going to happen to us, and to resell ourselves and our people on our ability to step out and take a place at the front of the parade. I could spend the rest of the morning marshalling facts to prove that this industry of ours has:

1. The products and services to merit a position of leadership in American business and industry.
2. The experience and ability to achieve such a position.
3. A future outlook that warrants our facing ahead with confidence and optimism.
4. The manpower to accomplish these things.

Perhaps we need a redefinition of the responsibilities of leadership. Let us for a moment see to what extent our industry possesses the attributes which merit the public trust, confidence and the recognition given to a leader. I have set up some standards by which leadership may be measured. How do they compare with the industry's record and its future?

B: Leadership connotes character and integrity.

There can be no criticism of our industry today from the standpoint of its character or of the character of the men and women in it. We have a record for fair dealing. Our products and services are fairly priced. We are good citizens. Critics of our past mistakes must admit that they were mainly errors of judgment rather than of intent. No leader has yet lived who has not at times been misled in his judg-

* An abstract.

ment, and who has not been the greater as a result.

B: Leadership demands courage.

A leader of any kind inspires jealousy, invites attack. Our industry has had more than its share of vituperation and interference. It has faced this situation courageously; it has not dodged any issues. Although skies today are clearer, the future will unquestionably demand a further display of the same kind of courage which has preserved the industry through storms which might have wrecked less valorous and self-reliant industries.

B: Leadership requires human understanding.

Because our industry deals more intimately with the daily lives of more people than any other, human relationships play an important part in our success. Our reputation in this respect has been only fair. However, events of the past few years have focused attention on the importance of human relations, both inside and outside the industry. Let us continue to be more human in our dealings with our fellow workers and the public which we serve.

B: Leadership without vision must fail.

The record of the electrical industry in this respect is incomparable. We have anticipated public demand for our services. Our researchers have contributed countless devices for its improvement and for enhancing the comfort, convenience and happiness of the public, and for improving the efficiency and productiveness of the American business and industry. There has never been and never will be a let down in our progressiveness.

B: Leadership implies the ability to cooperate.

We can be proud of our record in this respect, particularly here in the West. But even with the progress made thus far, there are still greater opportunities for all branches of the electrical industry to participate in cooperative activities for the common welfare. Cooperation promotes mutual understanding, which is essential to harmony and progress.

B: Leadership must include tolerance.

The industry itself and the men and women in it cannot succeed without a disposition to tolerate opinions, beliefs, practices and conduct which might differ from their own. Lack of tolerance has scuttled many a project on the rocks of bigotry. Fortunately there have been but few examples of intolerance in the history of our industry.

B: Leadership thrives on enthusiasm.

We must be sold on our jobs and our opportunities. Our individual and collective morale must be high. If the past few years have dimmed either enthusiasm or morale, then the promising outlook for the future should bolster both to new heights. My recommendation to those who view the future of our industry with doubt or misgiving is to get out of it now. They will be left behind if they stay in it.

B: Leadership will be maintained by good salesmanship.

The electrical industry's greatest opportunities lie in the market place. It is here that our competition for leadership will be the most intense. Some of our self-critics ascribe much of our progress to date to public demand rather than to our ability to sell. Be this as it may, it will behoove each and every one of us to improve our salesmanship. We have a tremendous advantage in that we have so much to sell which the public needs and wants.

B: Leadership, finally depends ultimately upon performance.

In order to be a leader, *we must lead.* Unless our performance lives up to our promises and to our opportunities, we simply will have run a good race and lost. We have the means to achieve leadership, let us then have the will to win.

Residential Sales Bureau*

Modernizing the Kitchen

Report of Home Modernization Committee†

By E. E. WALKER
B. C. Electric Railway Co., Ltd.

THE FOLLOWING do not represent sent conclusions of the author but are based upon answers to a series of questions addressed to the merchandising departments of association member companies.

Replacement Sales of Electric Ranges

The concensus is in favor of seriously tackling the problem of replacing old equipment as quickly as possible.

Old equipment is slow in performance, lacks automatic control and is less efficient than modern equipment.

Nothing is to be gained by reconditioning any equipment that is not fitted with automatic control.

In reconditioning an electric range for resale, even if it is fitted with automatic control, we should see that it has the latest high speed elements to insure quick performance.

A uniform schedule of trade-in prices, similar to that which prevails in the automobile industry, should be agreed upon by the trade.

The volume of replacement sales was reported to range from 22 to 50 per cent of the total.

A limit of ten years to be placed on equipment for which a replacement value would be allowed.

No definite information was received in answer to the question "How much can be spent to place a second-hand range on the lines?"

The maintenance of existing revenue and the competition of other fuels, such as wood, coal, gas and oil, compels consideration of some replacement value on old equipment.

The Portland General Electric Co. produced a very complete equipment replacement valuation list which they find useful in maintaining a standard practice in their territory.

Trial Plans for Ranges & Water Heaters

The word "trial" indicates a lack of public acceptance.

This may be necessary for the electric automatic water heater, because of its higher cost of equipment and installation.

It is not necessary where the electric range is concerned.

The evolution of heating water electrically; commencing with the unlagged tank and either an emergency type or circulating type heater, down to the

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† E. E. Walker, B. C. Electric Railway Co., Chairman; Appliance & Merchandise Division, General Electric Co., R. M. Loughrey; The California Oregon Power Co., H. A. Young; Eastern Oregon Light & Power Co., Leon Gray; Graybar Electric Co., F. J. Brien; Grays Harbor Railway & Light Co., H. G. Kelsey; Idaho Power Co., Fred Ingraham; The Montana Power Co., C. J. Burns; Northwestern Electric Co., William Bell; Pacific Power & Light Co., Guy E. Davis; Portland General Electric Co., Fred G. Starrett; Puget Sound Power & Light Co., Harley Bryant, C. W. Sherman; Utah Power & Light Co., J. F. McAllister; Washington Gas & Electric Co., E. J. Ludeman; The Washington Water Power Co., R. B. McElroy; Westinghouse Electric & Manufacturing Co., C. W. Kaylor.

present day with the automatic, well-insulated, booster type of equipment, is representative of the progress we have made. But the inefficiences of the past, which have not yet been lived down, make it necessary to show our confidence in this equipment by suggesting a trial installation.

A 30-day period was suggested as being ample for this purpose, but it might be better to extend this on the basis of rental-purchase terms, for a period of six to twelve months, in order to give the customer the opportunity of becoming more used to it.

It was suggested that trial plans sidetrack good selling methods.

Importance of trial plans diminishes as merchandise is accepted.

To the question "Why should the dealer sell the installation of the water heater at cost price?" the answer was that the installation cost included a profit for the plumber and that it would not stand two profits. It was further deemed advisable not to segregate the installation cost from the cost of the equipment.

It was suggested that there was a general lack of knowledge on the part of those installing electric water heaters regarding the use of water by the consumer.

Education of the Sales Staff

It is generally agreed that a little knowledge is dangerous and that we have a responsibility to our sales staffs to see that they are well posted with a knowledge of equipment they are selling.

It is first necessary to make sure that the salesman has a good grasp of the fundamentals of selling; and it is a good idea not to assume that he has this, for even if he has, a repetition of the fundamentals serves to strengthen his position.

No useful source of information should be overlooked, and the manufacturers', and jobbers' services should be enlisted in connection with this subject of "education."

The use of the movietone lantern as a sales educator is one of the latest and finest aids to selling. Group meetings are of considerable assistance to those concerned, giving as they do a contact with opinions other than those held by the salesmen.

The highest class sales instructor is none too good for any business.

The electrical industry is taking a leaf out of the book of the automobile trade through the medium of the greater use of visual training.

Dramatize selling whenever possible.

The utility members appear to be alive to the necessity for sales staff training but lack a uniform program for the industry at large.

R. B. McELROY, E. E. WALKER and W. A. HUCKINS

Home Service Department & Kitchen Planning Service

The service is one of our most up-to-date aids to selling the idea of doing it electrically. We are dealing with the workshop of the home and there is no reason why it should not be as efficiently conducted as the office or the factory.

Convenience, efficiency, comfort, beauty are all strong appeals to the "little woman in the home." It would appear that we are again taking a leaf out of the automobile salesmen's manual when putting forward kitchen planning service. The automobile salesman does not sell you a 6- or eight-cylinder engine, consuming so many gallons of gas per 100 mi. He emphasizes the style and beauty of the body, the seating comfort, the interior decoration and maximum convenience. We are doing the same through this new service.

The Portland General Electric Co. reported that it worked on 1,483 kitchen plans, and of these 66 per cent were executed in accordance with the recommendations. They made 1.7 major appliance sales per kitchen plan. The cost per plan adopted and sold amounted to $8. The coloring of the perspective drawings was advocated. It was suggested that the order of sale of the major appliances was (1) water heater, (2) refrigerator, (3) range, (4) dishwasher.

Due consideration should be given to the mechanics of the follow-up, dealing with the materials to be used, carpenter's, plumber's, and painter's work.

Reference was made to cutting down the size of the kitchens, thus making them food preparation rooms only. It was suggested that as a result of this the consumption of energy is being lowered rather than increased.

Views were expressed to the effect that home service girls should be educated in the use of electricity to the extent that all complaints would be eliminated, but that girls should not be used as trouble shooters. Further, that in making their contacts they should get out to the new user as soon as possible.

Merchandising

The question of whether the public utility should merchandise at a profit or as a loadbuilding department is a controversial one.

Dealers outside of the public utility are naturally not in favor of merchandise as a whole being sold at cost. They recognize that the utility has to build up certain public acceptance which they cannot afford to do. This calls for expenses which are out of proportion, and it follows that the utility is not able to make a profit on the sale of equipment.

It must be recognized, however, that somebody has to perform this particular work and it therefore falls upon the shoulders of the utilities, manufacturers and jobbers to take the lion's share.

As dealer cooperation grows and public acceptance is developed, this, as the years go by, should become a reducing factor with the exception of new equipment that may be developed as an original departure from that in use.

The question was raised as to what was the effect on the sale of small appliances in those cases where the utility companies are confining their sales efforts to the major appliances only—ranges, water heaters, refrigerators. It was stated that there was a tendency for a lack of interest to be shown by the dealers who were inclined to specialize in a manner similar to the public utility, thus leaving the small appliances to the department store and hardware dealer.

It was suggested that to remove the competitive element from the utility salesman's work, he should be paid on a basis of estimated revenue rather than a percentage of sales.

It was also suggested that payment of salesmen on straight salary basis rather than commission tended to maintain better goodwill towards the utility than before. In one case the first class salesman was paid $300 per month and the low man $150 per month.

The keeping of accurate merchandise cost data is becoming more important in view of the interest being taken by public utility commissions when analyzing the cost of service to customers and determining revision in rates.

One Northwest utility company discontinued merchandising five years ago and believes that it made a correct move in so doing. It credits the dealer with sincerity of purpose and gets him to go after business from a unit point of view. Quotas are set up for the year in the same way that applied when the utility merchandised.

A careful study of the limitations of

dealer activities in each city was suggested.

Two schools of thought appear to exist, one in favor of the public utility merchandising and the other against the utility merchandising. The consensus was that a well balanced plan coordinating the merchandising activities of the utility with the dealers, whereby all would put their shoulders to the wheel, would be the best procedure.

Dealer Cooperation

Some very interesting questions were asked as a build-up for the dealer cooperation paper and it is clear that as a unit the dealers are a very important factor in the development of new business. Close contact should exist between the public utilities and the executive of the dealers' association. If no association exists, the utility should do its best to get dealers together so that they can meet and discuss their problems on common ground, learn of the utilities' plans and be able to signify their cooperation.

The question relating to the bonusing of dealers for load added and other concessions resulted in the opinion that emphasis on free wiring was wrong in principle and one of the weaknesses in merchandise practice.

One utility with 79,500 customers, leaves the whole of the merchandising to the dealers and reports dealer sales totalling $438,000, an average of $55 per customer.

The value of merchandise maintenance contact was emphasized as being a valuable one to maintain.

One member present said that the most cheerful and optimistic meeting he had attended in connection with the trade of recent years was during the past year, when the utility companies in the Buffalo, N. Y., section decided to resume merchandising.

It was suggested that in another area where one utility company had decided to cease merchandising, the competing utility instead of the dealer had taken up the merchandise slack thus created.

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Replacement Sales

By F. G. STARRETT
Portland General Electric Co.

IT is the opinion of this committee that it is necessary to replace, as fast as possible, all electric ranges which have been in service ten years or more. This practice keeps the customer's equipment modern and up-to-date and also keeps the customer satisfied with electric cookery.

Electric ranges, two years old or less—Table 1

1.	3 burner, side oven, full porcelain (combination or plain)	$35
2.	4 burner, side oven, full porcelain (combination or plain)	45
3.	3 burner, table top, full porcelain (combination or plain)	40
4.	4 burner, table top, full porcelain (combination or plain)	50
	No oven control, deduct	10

Electric ranges between two and three years old

5.	3 burner, side oven, full porcelain, (combination or plain)	$20
6.	4 burner, side oven, full porcelain, (combination or plain)	30
7.	3 burner, table top, full porcelain, (combination or plain)	25
8.	4 burner, table top, full porcelain, (combination or plain)	35
	No oven control, deduct	10

Electric ranges manufactured after Jan. 1, 1927

9.	3 unit, 14 in. oven, semi enameled	5
10.	3 unit, 14 in. oven, full enameled	7.50
11.	3 unit, 16 in. oven, semi enameled	7.50
12.	3 unit, 16 in. oven, full enameled	10
13.	4 unit, 16 in. oven, semi enameled	10
14.	4 unit, 16 in. oven, full enameled	17.50
15.	4 unit, 18 in. oven, semi enameled	10
16.	4 unit, 18 in. oven, full enameled	17.50
	If not equipped with temperature control, deduct	2.50

Electric ranges manufactured prior to Jan. 1, 1927

17.	All porcelain enamel with temperature control	10
18.	All porcelain enamel without temperature control	5
19.	Semi enamel with or without temperature control	5
	If equipped with porcelain lined oven, add	5

There is without question a large market for good used electric ranges. But since this market consists of lower income customers who are replacing non-electric appliances, we must first of all be able to take this range in at a reasonable figure so that it may be resold at a fair price.

One locality has met this problem by uniting almost all the retail outlets under the name of the "Central Appraisal Bureau." Monthly dues are levied on each concern in relation to its volume of business. A committee then establishes a trade-in schedule for both electric and gas ranges as well as old ice boxes.

The electric range trade-in schedule with which this paper is solely concerned, is covered under four different group classifications as shown in Table 1.

Adherence to this schedule has almost entirely done away with excessive trade-ins, and as a result the electrical dealer who formerly had a red figure in his used range department is now able to show a fair profit. There has been very little violation of the above schedule by members of the bureau.

All ranges taken in that have any value are reconditioned to the extent that they will operate satisfactorily and will make the housewife who purchases one a booster for electric cooking. Obsolete models with their relatively slow cooking methods should be, and, in most cases are, junked.

After the trade-in value has been established from the "appraisal sheet," the sale price should include enough margin to compensate for sales expense and a reasonable overhead expense. We believe there should be at least a 45 per cent mark-up after all cost of reconditioning has been added.

The above percentage allows for a reasonable overhead plus at least a 10 per cent commission for the salesman, providing the salesman is paid on a straight commission basis or a salary and commission. If he is paid on a loadbuilding basis he should receive the same compensation as on the sale of a new range, as the revenue derived is just as great.

It is very necessary that the trade-in be reconditioned to the extent that it can be guaranteed for a 12-mo. period against mechanical defects. Most of the sales will be on a conditional sales contract and, as we all know, until the last payment is made the sale is subject to adjustment. Switches, controls and elements, which constitute the major parts used to recondition the ranges, are today very much improved and should cause no serious trouble.

We are of the opinion that it would be a fine thing for the local utility in cooperation with the dealers to put on a concentrated drive once or twice a year in an effort to replace as many old ranges as possible. I am sure that every company in the Northwest has on its lines a large number of ranges which will average anywhere from 10 to 18 years' service and which we will admit do very little to recommend electric cookery. The committee believes that a large number of these ranges, if properly reconditioned, priced and sold, will open up a large market to the lower income group of our customers.

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Trial Plans

By C. W. SHERMAN
Puget Sound Power & Light Co.

THE committee felt that a report covering the problems as represented by the Puget Sound Power & Light Co. would give the association a fairly representative picture. However, it has been necessary to digress somewhat from the subject as set forth in the original questionnaire. We also found that the major problem was the promotion of the automatic electric water

heater; therefore, the major portion of this report is taken up with that subject.

The flat rate method originally brought out to replace range coils which were eliminated when the electric range was put into the kitchen; the side-arm method; the combination of flat and metered—all brought a flood of problems and complaints from our customers. During the flat rate period, some customers got satisfaction from this service, but the majority did not. As complaints grew in volume we told the story of the side-arm heater. We explained to our customers that they could now obtain as much hot water as they desired and pay for only what they used. We know that one kilowatt would raise four gallons of water 100 deg. in one hour, but we forgot to advise the customer about necessary insulation and other incidental details. We thought we had solved our problem by asking help from the well-known furnace coil, but still our complaints rolled in. High bill complaints, overheated tanks, element failures. Those customers that had had any interest in heating water with electricity became skeptical.

Our next discovery in groping for the answer was the combination flat and side-arm heater. Here was the ultimate in water heating, and we were so firmly convinced that we asked our customers to convert their present equipment into this new service at a larger expenditure. Yet it did not solve the problem, for customers were asked to pay too much for installation cost and received too little in return for their investment. You will agree with me that this type of installation was mostly labor.

Then a new idea developed—the automatic, tank-type storage water heater with a low energy charge, mostly off-peak. Here was the answer to our problem—no more high bills, a service which was entirely satisfactory, dependable, convenient, automatic, carefree and, most of all, economical to operate. We had something that was justifiable from the utility standpoint; but what about our customers? Would they believe this new story that we were about to tell? That these new improvements would give complete satisfaction in every detail?

We had told the same story before with slight variations, and our customers' faith in us had had cause to waver. The utilities realized this so they said, "We will try the rental purchase plan." But the rental purchase plan tends to make the customer feel that there is no need to make an investment. Rental-purchase-plan customers may pay for use temporarily and never buy outright. This sometimes tends to increase the percentage of reverts. Do we want this? No. We want a complete outright sale of merchandise, not a sale in which, if the customer is not entirely satisfied, at the end of 30 days, a refund is made.

By this sales approach we appear undecided and in doubt. We put a negative idea in front of the customer, a big "if." Why not have a trial plan that has a definite and positive sales objective? Something that is simple and direct, has no ballyhoo nor great amount of advertising which would tend to give the customer the idea that here is another plan of the utilities to sell merchandise and so what?

Now for the simple but direct trial plan. Each salesman in the organization should be instructed that when telling the water heater story he may place a heater in the customer's residence for a trial period of 30 days, to prove to the customer that every point which has been stressed is absolutely as represented and that every family should have the protection, health, economy and convenience thus provided. This does not mean that the salesman will flood the office with trial installations, as will be shown later, but that each salesman has the opportunity of telling what this automatic, tank-type water heater will do: That it will save time and energy for the customer; that it will eliminate the need to watch, wait and worry; that it is simple, self-starting and self-stopping; that it is safe; that even a small child can use it without the slightest danger of any kind; that it is the cleanest, the most dependable and the most economical method of heating water. Every statement made can be proved, and if there is a question we are willing to prove it.

During the year 1936, with 69 men in the field, Puget Sound Power & Light Co. sold 2,194 automatic, tank-type water heaters. This was an average of 31.8 water heaters per man. In 1937, with an average sales force of 43 men, this same company, using the simple, direct method, sold 2,194 water heaters, thus giving an average of 51 water heaters per man or an increase in sales of 60 per cent per salesman. The number of trial installations for the year 1937 was but 146, of which 128 were sold. This would give us a percentage of 12.3 returns. With 2,194 water heaters sold, 146 trial installations represent a very small percentage.

MATERIAL USED

For Free Trial Water Heater Installations

1 —Meter and time switch
1 —No. 5550 entrance cap
4'—Three-wire S.E. armored cable
1 —No. 3204 connectors
1 —930577 base
1 —¾"—5 nipple
2 —¾" lock nuts
1 —¾" bushing
1 —No. 120 switch
50'—12-3 Tirex
50'—No. 8 R.C. wire
11 —35 amp lugs
2 —30 amp plug fuses
Two hours labor

For Free Trial Range Installations

1 —Meter
1 —No. 3208—1¼" connector
1 —No. 5537 entrance cap
2 —No. 3204-B—connectors
3'—No. 5 wire service cable
40'—No. 8—3 Tirex cord
40'—No. 6—1 Tirex cord
1 —No. 231 entrance switch
1 —1¼"—2 Hub Meter Base
11 —35 amp lugs
2 —40 amp cart. fuses
1 —1¼ x 6 galv. nipple
Two hours labor

The investment cost of this trial installation equipment is $16.94. When temporary installation is made, there is nothing that will interfere with the present set-up of the customer furnishing the electric equipment. So certain have been these trial installations that in a number of cases installations were made permanently because of the shortage of temporary set-ups, and we experienced no loss for they became sales after the expiration of the trial period. By this simple and direct trial story we have broken down that sales resistance on electric water heaters which so many of the utilities in groping for the correct method of heating water with electricity have unfortunately developed. Very little sales promotion ballyhoo is needed, since this is a direct answer to the problem of selling automatic electric water heaters, where competition of fuel-type storage heaters with a low energy charge is intense and where customers are very much rate conscious.

Relative to the range situation, we have found that the greatest good accomplished in this line was the availability of the trial plan. Puget Sound Power & Light Co. during 1937 placed only 20 ranges on trial, nineteen of which were sold. However, all districts and divisions of the company were supplied with trial installation material which cost $29.

We cannot stress too much the dominant fact that the availability of the trial installation plan for both ranges and water heaters gives the salesman immeasurable confidence in selling the merchandise and also instills that confidence in the customer. By personal contact with a good many salesmen using this plan, we found that a larger part of our sales was due to the clinching argument that the company had enough faith in its merchandise to install it on the customer's premises for a 30-day free trial than was due to actual use of the plan.

With the exception of the cost of the electric energy used the trial plans covered in this report were made at no expense to the customer. The only paper necessary for the customer to sign was a release form showing that the merchandise was on consignment at the customer's promises.

Education of Sales Staff

By LEON G. GRAY
East Oregon Light & Power Co.

OUR first requirements of a salesman are that he be honest and a salesman by choice. Thus he will quickly develop his personality to meet the public demands and satisfy his employer; he will easily acquire the poise required in making contacts. He must be friendly and adaptable so that he can make helpful suggestions and actually be constructive in offering criticism where a remedy can be recommended. The up-to-the-minute sales information given out by manufacturers and jobbers offers a most satisfying source by which the salesman can practically educate himself.

Certainly knowledge is power in the hands of the electrical salesman serving a utility. Not only must he know every inch of his merchandise inside out, but he must familiarize himself with rates and costs of operations of appliances so that he may intelligently discuss the customer's problems with him. He should know the policies of the company he serves and acquaint himself with the merchandising department so that he may use his judgment when trading is to be considered. Such information will establish confidence in the customer.

We do not employ any special training methods to establish our salesman. We simply acquaint them with such information as comes up in our daily routine, thus giving them every advantage from the management point of view and affording them the opportunity of acting upon their own initiative. This method, of course, could only apply to the small sales staff where no other method would be practical.

We hold weekly and monthly sales meetings to consider immediate problems. Everyone may make suggestions and usually satisfactory conclusions are reached. All departments are represented at certain specified meetings thus keeping the divisions in touch with each other. We attend sales meetings conducted by utilities operating near our territory. When possible, we attend sales meetings conducted by manufacturers and jobbers whose merchandise we sell. The cost in dollars and cents is not great when the employer considers the stimulation and encouragement created by contacts with manufacturers and jobbers.

Newspaper advertising has a place in creating interest and is probably one of the best ways to introduce the advantages of electricity, which advantages the salesman must sell in order to sell his merchandise. From the standpoint of education, advertising merely gives the salesman another angle with which he must acquaint himself from his company's point of view.

The cooking school campaigns in our territory have been highly satisfactory and bring each salesman in direct contact with all persons attending. Registration cards are a means of acquaintance and are important for the information they contain.

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Sales Promotion By Employees

By E. J. LUDEMAN
Washington Gas & Electic Co.

THIS paper is concerned with the steps to be taken in promoting among employees on other than sales jobs a recognition of the importance of promoting sales and good will and a favorable attitude toward these activities.

So much has been said and written on this and closely related subjects that unless it is approached from a different angle it will be simply the "same old stuff." In order to attempt to get this different angle, let us analyze our problem by asking four questions.

1. What is the obvious thing we are trying to bring about?
2. Why do we wish employees to participate in sales promotional work?
3. What benefit does the utility, and the employee himelf, derive by taking part in sales promotional work?
4. What would be the effect on our customers, the public, if each employee were sales minded?

1. We want our employees to participate in sales promotional work. They haven't been taking part in this work, or at least not to the extent we would like to have them because (a) they are not interested, (b) they are not trained to take part, (c) they are of the opinion that it will be of no benefit to them. Consequently, if we can interest the employee, train him and show him it is to his advantage, we have hurdled the biggest obstacle.

2. We wish employees to participate in sales promotional work. (a) It will benefit the employee. (b) It will benefit the utility.

3. Benefits derived from employee participation. To the utility—(1) In sales contacts with customers. (2) Better public relations. To the employee —(1) He is a better employee. (2) He increases his income.

4. Effect on the public of sales minded employees. Some employee has contact with almost every one of our customers during the course of a year. If the employee making a sales contact is sales minded, his every action is to create good will and open up every possible avenue for load building.

The problem therefore resolves itself into just two sub-divisions: (1) a plan of employee education or training. (2) a plan for employee participation.

Plan of Employee Education or Training

The organizing of employees of all departments in a utility into a sales force for selling not only appliances but, more particularly, service in general has benefits other than added load and profits from appliances sold. To a far greater degree it is useful because each employee thus acquires a commercial viewpoint which should improve the nature of his contacts in his daily work.

Too often in the utility field we find the employee of operating and inside departments grumbling about his job when he meets outsiders and personal friends. The negative effect from this must be extremely great. However, if the employee is always on the lookout he will not air his personal grudges, if he has any, and the entire tone of the employee group as it meets the public will be marvelously improved.

The problem of increasing load, producing the sale of equipment in districts that have a relatively small number of meters, is one of great difficulty if the expense of the promotion is kept anywhere within reason. For example, a district of 400 residential customers will scarcely support one salesman even if all the customers' appliances were replaced on a normal basis of expected life. If the manager of such a district is commercially minded and a good personal salesman, a great deal can be accomplished, provided leads are supplied to him by the operating and inside office employees.

Plan for Employee Participation

The right kind of a setup must be established so that the employee is compensated for these leads and for such assistance as he can render in closing them; and the finishing touches of the sale can be taken care of by the district manager himself. Now there is no finely drawn line between closing a sale and developing it, and unless the employees receive sales training they cannot effectively locate and develop these leads.

All sales programs and campaigns

must also be made very simple. While the sales organization will probably bear the brunt of the campaign activities, the other employees must be given the breaks. Their work must be given greater recognition than the sales force so that the interest of all the employees is maintained during the progress of a campaign. Many of the prospects can be developed by collectors, meter readers and service men who call on the customer many times, each time mentioning some features of a new appliance and gradually building up interest. Such prospects and the sales resulting could not be unearthed by a regular salesman.

Among the advantages of employee selling are the following:

(1) The employee is regarded by the housewife as one who knows his business and she believes what he says, whereas she may be suspicious of the strictly sales person.

(2) The employee, particularly if from the operating department, can adjust and repair appliances and render real help to the housewife. This is usually not the case with the ordinary salesman.

(3) The operating or other department employee is usually a permanent fixture in the district and has a wide circle of acquaintances. Salesmen seem to change their jobs frequently.

If we could interest the major portion of our employees in our load building program and they made only one contact a day, we would have multiplied our sales force many times. Besides this, we would have reached many customers who would otherwise not be approached.

Home Service and Kitchen Planning

By H. A. YOUNG
California Oregon Power Co., Medford, Ore.

and GUY E. DAVIS
Pacific Power & Light Co., Yakima, Wash.

WE have every reason to believe that women are as interested in kitchens as they ever were. A check shows that there are more requests for information on living rooms and kitchens than on any other rooms in the house. From the answer to the question in our survey, "If you could do over one room in your house, which would it be?" it is evident that kitchens will be second on the list. In the groups of houses at the Chicago Century of Progress, there were more comments on the kitchens, Venetian blinds and twin beds than on any other features in the houses.

We also have reason to believe that women are more interested in their kitchens as a whole than they are in individual appliances. For instance, articles dealing with kitchen planning and showing an attractive kitchen have a higher attention rating and reading than straight equipment articles. Second, at home shows the country over, model kitchens have a larger attendance than booths displaying equipment. Third, a count on coupon returns from advertisements in consumer magazines featuring complete kitchens shows a higher return than the showing of only refrigerator or range advertisements.

It is comforting to know that you will not have to hoe this row of kitchen modernization alone. The ground has been prepared. Women know that there have been new developments in kitchen equipment planning. The women's magazines have promoted the idea. The EEI and the NEMA have organized the National Kitchen Modernizing Bureau and are putting thousands of dollars into its program this year. They have just published a book on kitchen planning which is the last word in the field.

In planning to take advantage of this great opportunity, first consideration must be given to the best interests of the future customer. The utility has a very definite obligation to see that the customer is going to get the maximum in the way of service over a period of years from money expended for equipment and service. Through the medium of a kitchen planning service and a well-organized home service department, this obligation may be met in a very satisfactory manner.

Kitchen planning is simple. Just because you haven't a kitchen expert sitting at the next desk, never for a minute stay out of kitchen planning. Anyone can learn the simple rules in a short time, because all the authorities have put their heads together and have agreed on certain fundamentals that eliminate confusion.

In the home kitchen there are three centers of operation: (1) the refrigerator—preparation center; (2) The sink—dishwashing center, and (3) The range—serving center.

Each of these centers can stand as a complete unit in itself, but their relationship is important in saving steps and obtaining greater efficiency.

Every salesman should be thoroughly conversant with the generally accepted principles of kitchen planning. Moreover, in the sale of each piece of equipment he should take care to see that the equipment sold is installed in the right place in the kitchen. The salesman should also have a few kitchen color schemes in his pocket just to intrigue the customer. It is the psychological time to make such a presentation, because the new range or refrigerator is bound to make the rest of her kitchen look shabby. If the modernization idea is properly planted and a kitchen plan book or sketch left in her hands, another equipment sale is apt to be made in a short time in order to complete the kitchen.

It is also vital to get in touch with the builders and architects in the community to insure well planned kitchens in the houses of your district.

The home service department should function as educators, goodwill builders and to follow up complaints on domestic equipment. Its function should be to call upon new customers as soon as merchandise is installed, to teach them the proper uses of their equipment. It should not be used as a direct sales medium, especially if a dealer-company cooperative promotional and sales program is in effect. It is to the company's interest to have dealer equipment receive the same consideration as the equipment the company sells, and the home service department, in order to be able to work with dealers to the best possible advantage, must have their confidence. Therefore it would seem wise to confine the efforts of home service employees to promotional and education work.

The activities of a home service department should include company cooking schools, dealer-company cooperative home makers' institutes, group demonstrations before schools, clubs and neighborhood gatherings as well as home demonstrations. Another very important phase of the program should be to follow up complaints of users of appliances sold by the company and dealers.

Cooking schools should be held periodically in all districts where it is thought such demonstrations would find acceptance, as they have been proven a general help in promoting sales.

Group demonstrations before schools have been very satisfactory, many such institutions having been completely equipped with electrical appliances as a result of the efforts of the home service department. Work with women's clubs and various other organizations of this type has been very satisfactory.

Merchandising

By R. B. McELROY
Washington Water Power Co.

UTILITY companies in the Northwest in general have given up the term merchandising in favor of the term loadbuilding. This likely has been brought about by the ever-increasing activity on the part of dealers. In fact, a report from one company shows that, of the total electrical equipment sold for the home during 1937, the utility sales amounted to only 12 per cent. Upon further analysis it showed that of the total EAR added to the lines of this utility, 80 per cent was added by dealers—and it must be made clear that the operating utility was very active during the year.

The general opinion among utility men is that these so-called merchandise departments should operate at a small profit. If this is not done, there might be a tendency for other outlets to feel that the utility merchandising department is being subsidized at the expense of the rate making base. This would be an unhealthy condition. Because of the increasing trend of most utilities to promote "use of service" advertising rather than product advertising to encourage more dealer participation, it becomes difficult for a utility any more than to break even on a strictly merchandise operation.

In analyzing residential and farm cost operation of most utilities in our group, it is found that the additional net residential and farm EAR quota the Northwest companies have budgeted for 1938 varies from 7 to 16 per cent of their 1937 residential and farm revenues, the average of these companies being about 11½ per cent. In other words, during 1938 the several Northwest companies analyzed expect to add to their lines loadbuilding equipment that will pay them about 11½ per cent of the total 1937 residential and farm revenue. Expressed in still another way, the residential and farm unit sales cost of these companies varies from 68c to 98c per dollar of additional EAR, the average being about 90c. This means that for each $1 of EAR added to the lines of these companies, the average sales cost would be 90c. From another angle, it can be said that these companies will pay out from 6½ to 11 per cent of their estimated 1938 revenues in sales costs, the average being about 10 per cent. This means that for every $100 of residential and farm revenue, these companies will pay out about $10 in sales costs.

The predominating practice in financing by most companies is to follow what is generally conceded to be the accepted practice by local dealers. In most cases, terms for the major devices run a maximum of 24 mo., the exception being when the terms are extended to 30 mo. All companies add a finance charge, usually one-half of 1 per cent per month.

In the past few years, salesmen's compensation has changed materially. Some years back it was practically all commissions, but today it seems to be the practice of most companies to pay the salesman on the basis of monthly salary with a small bonus for quota performance. This, no doubt, has been brought about by the fact that in most cases the salesman receives credit in one way or another for the sale of major appliances made in his territory by dealers.

At the present time there is quite a variance in the number of meters allocated to each salesman. At one time this figure was, with some companies, as low as 500 and as high as 3,500 with another company. The average is about 1,800. It is reasonable to assume that the increasing dealer activity will probably make it possible to increase the number per salesman as the better dealer outlets add outside salesmen to their forces.

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Cooperation from Dealers

By J. F. McALLISTER
Utah Power & Light Co.

and HARLEY BRYANT
Puget Sound Power & Light Co.

IN preparing something of interest on the subject of dealer cooperation your committee thought it advisable to obtain comments from member companies of the association. Therefore, a questionnaire was prepared and sent out to all member companies with the request that answers be submitted in a narrative form to eight questions outlined. Eight companies replied:

1. All of them answered "yes" to providing sales aids for the dealers.

2. Five companies answered "yes," one answered "no" and two did not comment on whether or not reports of dealer sales were obtained.

3. Five companies answered "yes," one answered "no" and two did not comment as to the value of sales bureaus.

4. Six companies answered "no" and two did not comment on the proposition of paying bonuses to dealers for merchandise sales.

5. Six companies answered "yes" and one did not comment on whether or not utility salesmen were compensated for merchandise sold by dealers. One answered "no."

6. Six companies answered "no" and one answered "yes" on the question of whether free wiring was provided by the utility. One, no comment.

7. Five companies answered "no" and two "yes" on the question whether dealer paper was financed. One, no comment.

8. Seven companies answered "no" and one did not comment on whether utility company did wiring.

As a result of the questionnaire, it appears that all companies are in accord on the general policy of dealer cooperation. Proof is offered of the effectiveness of sales training, cooperative advertising, shows, cooking schools and demonstrations.

The reports indicate that in most cases dealers are quite willing to submit figures on the results of merchandise sales which they have made. The contact made by utility representatives in getting statistics from dealers is worthwhile and affords an opportunity for building friendly relations.

The associated companies are in agreement that sales bureaus and clubs are helpful in the promotion of sales of items which may be featured through special associations. Radio clubs, running water equipment dealers, refrigerator, range, stoker, air conditioning and other types of dealers find that an association adds prestige and strength to any promotional activity.

The opinion seems to be unanimous that bonuses and subsidies to dealers for selling any merchandise are not necessary. Present margins of profit return some net to the dealer.

The companies reporting are also unanimous in their attitude toward paying utility salesmen commission on sales of major appliances sold by the dealers; the commissions, of course, being paid only on deals which have been developed by the utility salesmen.

Another point on which all the reporting companies are of the same mind is that wiring should be done by independent contractors. In a few isolated cases in sparsely settled territory without a wiring contractor, the utility has found it necessary to do wiring for major appliance installations as a convenience to the customer.

There seems to be very little need for utility financing of dealer electrical appliance paper. In most cases, banks and financing companies are providing all help needed to take care of term payments. The little financing that is being done by member companies is on a restricted basis. In one case the Electric Home & Farm Authority plan has been adopted to aid the dealers.

Home Service Report*

By EDITH RAUCH
Puget Sound Power & Light Co.

THE HOME SERVICE Committee sessions at the Medford meeting were taken up with the presentation and discussion of subjects that are of vital importance to the utility home service departments. Walter Potter, co-chairman of this committee for home lighting discussed the very important subject of evaluating home service work.

Promotional work for light conditioning in homes was discussed by Mary Dysart of the Washington Water Power Co. Miss Dysart set forth the benefits of the light conditioning program, explaining its application to the needs of the homes of the utilities' customers in 1938. A definite plan of campaign was discussed bringing out the desirability of close cooperation with both company and outside organizations. Light conditioning is a fine new sales idea which can be used to excellent advantage by the home service women.

Helen Swanson, Idaho Power Co., presented a report on effective home service methods of selling 12 months' use of appliances. This report was especially valuable to the home service departments because it clearly defined one of the most important objectives of their work. Year around use of electric appliances increases customer satisfaction, provides cheaper service, and at the same time the customer generally, will obtain a clearer understanding of just what value is received for his electric bill. By selling 12 months' use of appliances, the home service representative fulfills an important part of the responsibility of her position.

A direct analysis of the value of home service to selling has been difficult to obtain. Beth Fillmore, Portland General Electric Co., discussed visual demonstrations for groups of prospective buyers as a means to this end. She told of the cookery demonstrations made before groups of selected prospects invited to attend by the merchandise salesmen. The demonstrations progress much as the usual cooking school before a class of prospects, and have proven the plan to be a very forceful aid for closing range sales. The salesmen of her organization are unanimously in favor of the visual sales demonstrations and 62 per cent of the prospects attending the classes have been sold electrical equipment.

The traffic appliance business in the past two years has attained a volume comparable to that of some of the major appliances, according to the report on the load building possibilities of traffic appliances by Ethyl J. Warren, Westinghouse Electric & Manufacturing Co. She emphasized the importance of the load made possible with traffic appliances, by showing that these devices find a large potential market among the minimum bill customers. Although this load is highly desirable, the traffic appliance sales field is not limited to any one class of customers. Traffic appliances go a long way toward increasing the pleasures of electric service and in this connection the home service department should find ample opportunity to promote the satisfactory use of these devices.

A discussion of the economics of carrying on a home service activity was presented by R. Hall, B. C. Electric Railway Co. This paper presented a very instructive summary of the development of the home service idea in the electric utility business. Economic factors were behind the whole growth, and problems of economics have been important in determining the most efficient type of organization. All functions of home service work cannot always be effectively performed by one individual, especially in the larger communities. However, in rural territories it is often more desirable to have all phases of home service work handled by one representative. The report shows by actual home service department operating figures that this activity, rather than being an expense, adds materially to the utilities' revenue, with a generous increase of public good will.

An analysis of the problem of training personnel for a home service department was very well presented by Lucile Ramirez, The Washington Water Power Co. The selection of the woman for home service work is of considerable importance, and even the best prospect is not completely fitted for the performance of her job. It was pointed out that thorough practical and first hand experience and training are necessary to equip home service workers for their responsibilities. The home service woman is required to create and strengthen the bond of friendship between the utility and its customers and the utility and the electrical dealers. The enthusiasm, vitality and personality of the home service woman must be augmented by a thorough knowledge of salesmanship, as well as utility policies which can be gained only by thorough training.

EDITH RAUCH

The subject of training home service people from a manufacturer's standpoint was discussed by R. C. Padgett, Appliance Dept., General Electric Co., who brought out the similarity between the manufacturer's home service organization and that of a utility. This similarity of functions brings the two groups into contact with common problems and consequently their education and training proceed mutually and concurrently.

Making newspaper cooking schools pay dividends for your company was the title of a paper prepared by Cula Buker, Edison General Electric Appliance Co. The fundamental reason for such schools is sales promotion. The success of the venture depends largely upon the cooperation between the home service department, the newspaper and the cooperating advertisers. Correct emphasis must be given to the interests of each of the responsible parties and the method of appeal and presentation to those persons attending must be carefully considered. Their interest in the proceedings of the school must be retained throughout the school. Newspaper cooking schools present a splendid opportunity for the promotion of electric cookery, and the development of increased use of electricity for better homemaking.

Emma States, Puget Sound Power & Light Co., presented a paper dealing with effective sales promotion of equipment and lighting through dealer cooperation. The important position of the home service representative in establishing and maintaining good relations between the utility and dealer was explained. Home service women may help dealers, servicemen, and salesmen appreciably by explaining problems which most often bother the homemaker. These men have been given sales training in

* Edith Rauch, Puget Sound Power & Light Co., Chairman; B. C. Electric Railway Co., J. Mutch; The California Oregon Power Co., Marguerite Fenner; Idaho Power Co., Helen Swanson; The Montana Power Co., Ina Scrivner; Northwestern Electric Co., Mildred Elrod; Pacific Power & Light Co., Audrey Herrington; Portland General Electric Co., Beth Fillmore; Puget Sound Power & Light Co., Emma States; Utah Power & Light Co., Nancy Finch; The Washington Water Power Co., Mary Ann Dysart, Lucile Ramirez.

electric cookery by the home service department which has proven very helpful to them in carrying on their duties, and promoted good relations between the electrical dealers and the utility. The function of the utility to introduce new merchandise, as the I.E.S. lamps, and then turn the further development of the business over to the electrical dealer, was emphasized.

"Load Building Possibilities with Home Service" was the subject of a paper presented by James Buman, Northwestern Electric Co. The home service woman can produce load for her company through the promotion of greater use of present service, keeping the user sold on the use of the company service, and create prospects for additional equipment.

Extracts from the papers are presented in the following pages.

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The Whys of Home Service

By WALTER E. POTTER
Incandescent Lamp Dept., General Electric Co.

THE HOME SERVICE department not only performs a valuable service to the company in promoting public relations but it also plays an important, though often intangible part, in its sales activities.

Good will or customer relations frequently looked upon as a major objective becomes, in the last analysis, the result of successful home service operation rather than a justification for its existence.

Home service tills the field for appliance sales because it reaches the women who don't read advertising, or who don't believe all they read, and the women who don't like salesmen ringing their front door-bells. Home service is the personal face-to-face contact where advertising, at best, is impersonal. Home service pre-sells, sells and re-sells. Every activity of home service is designed to educate customers on the many uses of utility service.

By shaping and guiding the thinking of present and future customers, home service sows the seeds of desire in their minds so that less effort, time and expense is involved in the final selling of energy-using devices by company and dealer salesmen. Pre-selling or paving the way for future sales is accomplished through lectures, home calls, store demonstrations and other promotional activities not duplicated by other residential sales forces.

Home service personnel having the proper background of training and experience and being fully informed on the problems of the homemaker, are best qualified to explain use of utility service to other women. By employing an understanding approach home service sells through teaching.

The time of home service director and that of her staff is most profitable when devoted to activities which result in selling increased use, value and cheapness of all utility services to an ever increasing number of customers. A proper balance, therefore, must be struck in the work of the home service department. Sometimes a tendency develops whereby some one or two pet activities may predominate all others to the detriment of a well-balanced program.

Every call should be a sales call. Furnishing extensive free consulting service to a customer without selling something is neither desirable nor essential. Equally important is the ability to distinguish between visting and selling.

In order to make every call a sales call it must be thought out and planned in advance. This planning in its fundamentals and broad generalities, must be supervised and checked by home service director or supervisor and the result of every call should be systematically recorded and evaluated.

Job Analysis for Home Service Personnel

1. Follow prescribed schedules of reporting at the office, preparing daily and weekly reports and all prescribed data and records relative to the assigned work and results obtained.

2. Plan each day's work with respect to the program and activities in progress, including attention to scheduled features, demonstrations, calls and quotas. Don't run all over town each day answering complaints and service calls. Schedule your work.

3. Make home calls on the prescribed basis for the purpose of adding load by demonstrating new appliances, satisfying complaints, making home lighting surveys, and selling increased use of services already in the home.

4. Be well-informed on the use of all services and the selling appeals and facts regarding each service, as well as on general company information and policies.

5. Make sure that relations with all customers contacted are good and report any dissatisfaction which you cannot settle.

6. Whenever a customer is judged to be a prospect for additional service which the home service girl cannot sell directly, definite steps as prescribed should be promptly taken to see that the customer is sold.

7. On every call, sell the value and use of all services, sell the company and its policies, sell the fact that service is cheap, and sell all the BETTER LIVING benefits which the customer can obtain by more liberal use of service. Home service calls should have the following objectives: keeping present users sold on use of service; converting new users into satisfied customers; developing prospective users for additional services; restoring unused devices to use and developing prospective customers.

Light Conditioning—The light conditioning program offers a challenge to home lighting activities. This spring the I.E.S. lamp and shade makers are launching their advertising schedule around a new theme. A challenge has been issued to all to produce any lamp that has done as much to produce lamp buying by the public, sales profits for dealer and utility. It is recommended that all home service people become familiar with this advertising and the display material available for all merchandisers of I.E.S. lamps and shades. The booklet entitled "54 Challenge Comparisons" should be part of each sales person's kit, to provide sales ammunition assisting in further sales of I.E.S. lamps.

Adequate Wiring—One of the most important jobs for the home service department is to stress adequate electric wiring using such check questions on calls as:

1. Do the lights dim perceptibly when a large appliance is used in laundry or kitchen?

2. Do heating temperatures (irons, toasters, etc.) come up to temperature slowly?

3. Are fuses frequently replaced?

4. Must various appliances be disconnected to "plug in" others?

5. Is the arrangement of furniture dependent on the location of convenience outlets?

6. Must room be entered in darkness which may result in a fall before a pull chain or local switch is found?

7. Is electricity wasted by forgetting to turn off lights in the attic or basement?

Rural Service—The rural service departments of most utilities today realize the need for greater assistance on the part of home service departments. In most cases the rural representatives are entirely unfamiliar with adequate home lighting and particularly its application to the farmer.

The first use of electricity on the farm is for lighting. If farm lighting is properly sold and appreciated the road is opened readily to the sale of other current consuming devices. The farmer has need for as many if not more kw.-hr. of lighting than the city dweller.

On new rural extensions, all custom-

ers should be contacted by the home service advisor in cooperation with the rural service representative. Talks before granges, etc., have proven exceptionally helpful and profitable to both utility and farmer.

Evaluating—The most important factor in any operation today is evaluating the work performed. Executives ask, not only, "How much can we afford to spend," but "What are we receiving in return for each dollar of expense." The evaluating factors considered from reports and records are basically: number of home calls; number of group contacts; attendance of lecture demonstration groups; prospects secured from all contacts and E.A.R. added from appliances restored to lines, increased use of present services, prospects submitted to company and dealer salesmen and complaints in which loss of use is avoided.

Sales Tools—Visualizers for describing residential uses of service, lighting demonstrating equipment and sight meters all should be appropriately designed, fully understood and skillfully and habitually used.

One of the questions most frequently asked is "How many times can we afford to give free customer service to appliances no charge?" Do your records and reports show accurately how much time is being allotted to various field work?

Adequate records are necessary: as a substitute for guesswork and surmise, for determining where the most profitable business is, as the only intelligent means of judging sales trends and planning for future sales work, to guide promotional emphasis and selective effort and to keep track of man hours and expense as compared with results. They furnish a definite guide to home service representatives in taking stock of individual accomplishments as well as supplying tangible evidence of ability, progress and value.

Field work is important but so too is the complete record of such work. At the close of the year there should be available in the office of the home service director a complete, detailed account of the department during the year.

Reports Needed—Home markets available as to customers and prospects; surveys of territory and of applications of service, particularly to low use customers; data on revenue value of services to the utility; life of energy using devices; cost of promoting such services.

2. Report of home service group contacts to keep a record of demonstrations, listing such points as where and by whom given, date, name of organization and type of demonstration. Attendance, names and addresses prove useful to the sales department as a whole, particularly for special mailing lists.

3. Home contact record, which includes type of calls made in addition to results obtained. Type of calls includes: by whom made, number of calls, where an interview was actually obtained, appliances, customer and company request calls, in addition to home lighting, new customer service follow-up calls. Results listed as to equipment prospects, sales from prospects, appliance repair requests, appliances restored to lines, complaints satisfied, lighting watts and outlets added, all furnish a measure of the value of home service activities.

4. Lighting recommendation reports which include details as to lamps, wattage and shades recommended and sold in addition to rooms covered at customers' premises. Provision for recording actual results as determined by return calls is also essential.

5. Customer record file, preferably arranged on card index system and listed by location, forms an invaluable record of equipment recommended and results obtained. Such record may include survey data and other customer information of value in preparing mailing lists, checking coverage, return calls, record of monthly consumption, etc.

6. Weekly, monthly and yearly sales summaries and control records; for periodic analysis of sales results secured, of cost of attaining them, of prospective business and work in progress, of relationship of actual performance as compared with estimates and as a base for record of sales progress and accomplishment.

Once an appropriate, adequate and workable record system has been established which is suitable to the home service operations as carried out in harmony with the utility's territory and customer's it is paramount that such records be kept up-to-date.

In summary, to insure substantial progress, home service will require:

Provision and use of sales helps and sales aids to supplement and support demonstrations and lectures.

Training of dealer and company salesmen to understand the use of electrical services.

Developing greater company and dealer employee appreciation of the use of utility services.

Acting as the utility's representative to the home maker and the home maker's representative to the utility.

Supplementing and supporting—but not substituting for — direct selling forces.

Checking performance against planned objectives and costs so as to permit close production control and supervision at all times.

Finally the entire home service sales promotional activities of the utility must be based on the theme of selling the value and use of electric residential services to all customers to the end that the customer benefits from better living, the dealer benefits from better business and the utility benefits from increased use.

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Selling 12 Months' Use

By HELEN M. SWANSON
Idaho Power Co.

WHY SHOULD home service be interested in this subject? 1. We are interested in building load. 2. We find some homes where there are two or more types of cooking and heating appliances installed for the sake of doing the same job at different times of the year—as for instance, furnace coils and electric water heater; coal ranges and electric ranges. 3. Increasing sales by dealers, whose prime interest is in the profit on the appliance sale, require that the utility give attention to keeping the appliance in use and on the lines so that revenue from the use of that appliance enters our till 12 times a year, year in and year out. 4. In times of decreasing income customers are very apt to discontinue the use of certain appliances.

One reason that we have gone into a program of this kind is the fact that we believe our service should be sold to a customer just the same as though it were a pair of shoes, a hat or any other usable item. If you were to ask 100 customers which of their monthly household bills they felt was not justified or that they begrudged the payment of most, approximately 90 would answer with rent, telephone, water and electric bills—none of which are really sold to the average customer after the first month of usage. We feel that there must be reason why customers feel like this about certain bills; therefore, we have outlined the following mehod to try to better this condition.

First, our home service girls attempt to resell the customers on their present use of equipment. That is, we give them a good idea of the numerous purchases of our service made during each month by the equipment used, and an approximate cost of service for each. We break down the bill only enough to point out to the customer that it is

a most reasonable bill for the service received.

Next, our home service girls show each customer that to decrease her use of any appliance, which comes off of the low steps of the rate, is false economy. Decreasing use not only inconveniences her greatly and saves her only a few cents on her electric bill but also she will be unable to duplicate the same services with other types of fuel for so small a sum as is required for electric service. An example used by many of our girls is the family which vacations for two weeks out of the month and expects the service bill to decrease in the same proportion. After pointing out the fact that they use only the higher priced kw.-hr. and sacrifice the low priced kw.-hr. by not keeping up to their average, it becomes clear to most customers that cost and savings from decreased use do not go hand in hand.

The third step of each girl's call is to sell her customer on the fact that increased use of appliances is added on the low steps of our rates. If she has failed to sell 12 months' use of any single appliance up to this point in her call, she now takes each appliance one at a time and shows all the advantages that electric equipment affords. For instance, let's take the example of a customer who uses her electric range only three months in the year because during cooler months she needs heat in the back portion of the house. On our property the records of such a customer show that the customer saves $1.80 per mo. on her electric service for five months, but that the cost of coal for cooking during those months amounts to an increase in the total bill for the two services of $2.70.

Heat being the problem, however, we find that we must go one step farther and suggest ways of providing for heating this portion of the house, recommending, possibly, a special efficient kitchen heater, a wall grate, a small circulating fan or just leaving the doors open between the various rooms.

To sell 12 months' use of an electric water heater, the story is built around the fact that approximately 1/5 of one's fuel is used to heat water if a furnace coil is used as a means of obtaining the hot water supply in addition to the heat for the home.

Much proof is available on this subject notably from the research done by Purdue University, University of Washington and Massachusetts Institute of Technology. Each of these schools reports that in furances with water coils, from 12 to 23 per cent of the fuel necessary to properly heat a home is used by the furnace coil to heat the water. Furnace manufacturers, recognizing this, specify a 10 to 20 per cent larger furnace for a job when a furnace coil is to be used with it. G.E.'s specification sheet gives one the following: furnace model at maximum capacity of 100,000 B.t.u. per hour without hot water coil and humidifier, while with the coil and humidifier it has only 90,250 B.t.u. per hour, or 10.8 per cent difference in air heating capacity when fired to the limit. In our territory maximum capacity is rarely necessary and most often we find our customers using half capacity which would increase the fuel consumed in heating water to 21.6 per cent for the major portion of each winter.

To sell 12 months' use of small appliances many methods are employed. A thorough understanding of the use of each appliance on the part of the customer is most essential. Floor demonstration, advertising, etc., all help to keep these appliances in use.

Last, but not least, our girls do one more thing which I believe plays quite a part in keeping appliances in use and that is to sell our company to each customer. If a customer knows more about us and likes us, she will be much more apt to use the thing we have to sell—electric service.

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Cooking Schools for Prospects

By BETH FILLMORE
Portland General Electric Co.

OUR objective in these planned visual demonstrations for groups of prospects has been to do the best selling job we were capable of, to groups of people, then to measure definitely our sales results.

How Prospect Class Has Been Organized

To be really effective, the class must include only picked prospects, customers who need the equipment and have the ability to pay. Of course, the salesmen are the logical ones to furnish lists of these prospects, so the first essential is to gain the cooperation of the salesmen. Sell the salesmen on the prospect class! This can be done easily by simply conducting the class for them first. They'll immediately appreciate the sales merit of it. Then work out a regular system for them to submit names in order that the invitations can be mailed from the Home Service Department. When the salesmen do the inviting, the average customer immediately recognizes it as a means to get a sale and she is not so willing to come. We have used the postcard invitation and found it about 10 per cent effective. Each week approximately 100 cards are mailed and an average of ten prospects attend the class. It is possible to do much more effective work with this small group. Those not attending receive two more consecutive invitations. In comparison to the response received from invitations for user classes, this seems very low, but that can be attributed to the fact that the average prospect naturally resists being sold and feels that the class is a sales effort. The classes are planned for only a one-hour period, and are held at the same time each week in our company model kitchen.

As an added inducement to get them to attend class, all prospects who attend are given a copy of "Meals Go Modern Electrically" (from the National Kitchen Modernizing Bureau). In addition to being an inducement, this places some excellent advertising material in very fertile soil. Immediately after the class, the salesmen are notified about their prospects who attended, to insure prompt "follow-up."

Sales Material Given Prospect Class —In presenting the material in our prospect classes, the *Advantage-Proof-Action* method of selling is used entirely. The advantage is stated, the proof is visual — food is cooked to prove each point—and the action of course is in gaining the commitment of the audience, usually by means of a direct question.

Surveys conducted by leading range manufacturers have shown that women over the entire country who cook electrically prefer it because electric cooking is cleaner, easier, more economical and gives better results. In our classes, we try to prove to Mrs. Prospect that electric cooking will give her these same advantages that millions of other housewives enjoy.

After making our guests welcome, we start the class by telling them of this survey and stating very definitely the advantages of electric cooking.

Action—Read electric service meter that is installed at side of kitchen; (to be read again at the end of the demonstration and exact cooking cost figured. This to prove economy.)

Action—Start rice to cook (1 part rice, 1½ parts water—small unit on high until it steams; then turn off to finish cooking).

Discussion—Compare old method to new. Electric method is easier, gives better results, more economical. Emphasize advantage of "stored heat" cooking—other uses of this exclusive stored heat feature of electric ranges.

Action—Take layer cake from refrigerator; put in oven; show sliding and lock stop shelves. Set minute minder.

Discussion — Ease of baking electrically—all work is done by temperature control and minute minder—no

peeking necessary; perfect results, browning, raising, texture, etc. Discuss baking at home. Visualize by showing comparative amounts and quality of foods baked at home and those purchased with same amount of money. (Amount determined by total cost of ingredients, current and 30 cents an hour for mixing time on home product.) Get their commitment on this point—it pays to bake at home when you have a dependable electric oven that gives perfect results every time.

Action—Start broiling of ground meat patties. (Use ground meat to show that it isn't necessary to have expensive meats to broil).

Discussion—Give briefly method for broiling; uses of broiler; and explain why broiling has following advantages: Cleaner, easier, gives better results, more healthful. Call attention to bonfire cooking—people all prefer hot *coals* to *flame*. Hot glowing coils of the electric broiler unit resemble bonfire coals—no flame.

Action — Start cooking of pared, diced, raw beets.

Discussion—Old method was complicated, expensive, but it was necessary to follow old method with an old range, where heat could not be accurately controlled. New simple electric method made possible because of perfect heat control and direct heat conduction into bottom of the pan. Advantages: Easier, more healthful, more economy of time and current.

Action—Take complete meal from thrift cooker. (Braised short ribs, carrots, onions, potatoes, steamed fig pudding.) Display attractively.

Discussion—Cooker meal is started before class to show how the thrift cooker will give free time from the kitchen. Discuss this economy of time and current; uses of cooker; compare cooker and simmer burner.

Action—Serve samples of food to audience, to prove better results. Give out books, "Meals Go Modern."

Discussion — Summarize advantages of electric cooking. Get commitment.

Direct Sales Results of Prospect Classes

It seems only fair in checking sales results to allow a reasonable length of time to elapse between attendance at class and the closing of the sale. We decided upon a 3-month period. A check on February 1, 1938, on the results of all classes given before November 1, 1937 shows: Average attendance—10, with range sales closed in 62 per cent of the cases.

The sales organization has accepted the prospect cooking school as just one more aid in helping them to close sales. The original antipathy has been displaced by enthusiasm and they now volunteer prospect's names.

Small Appliance Load Building

By ETHYL J. WARREN
Westinghouse Electric & Manufacturing Co.

THE TRAFFIC appliance business is a *big* business! Analyzing it from the standpoint of retail volume, we find that it is comparable to the volume obtained on some of the major appliances. In 1936 there were 46,250,000 traffic appliances sold in the industry. In 1937 49,500,000 were sold. We should no longer call this a "small" appliance business as we have in the past; it is a *big* business, and interests every manufacturer and dealer.

These appliances increased current consumption to over one billion kw.-hr. last year. This warrants consideration by everyone. The traffic appliance business is a smart business, and part of your efforts should be devoted to promoting these appliances, studying the best means of attracting attention to them, and demonstrating these current consuming devices.

The market falls into three classes, the minimum bill customer from whom we get our greatest volume, the home-maker who entertains, and the customer who selects such appliances for gifts.

It is obvious that the most important market is the minimum bill customer. This customer needs and desires these appliances. Again, figures given by the industry show that a minimum assortment of these appliances put into use in a customer's home will increase his consumption by 596 kw.-hr. annually. Many times one spends a great deal more time and effort promoting the sale of major appliances which do not increase the load any more than this.

The home entertaining market is very important also. Such appliances as roasters, coffee makers, sandwich grills and waffle irons are more and more in evidence on tables set with gleaming crystal and silverware when Mrs. Home-maker is entertaining. Manufacturers are conscious of this and are featuring style-matched designs in all of these appliances so that more can be added from time to time and complete ensembles acquired.

The same promotional ideas will attract the third market, the customer who is interested in purchasing a gift and will help to stimulate this business.

Summing up the market: We realize that the best approach is the home theme, and we should demonstrate the usefulness of traffic appliances to these customers.

How shall we go about attracting attention to appliances? We are helped greatly by the national advertising manufacturers are doing. There is no doubt though, that one of the best methods of sales promotion is the demonstration. In this we concentrate on what the appliance will do to make tasks easier and more simple.

For dealer cooperation the demonstration is especially good. It not only helps to increase your business and his but it increases good will. The smaller dealer for whom you are conducting a range cooking school will always appreciate a demonstration of any traffic appliance which can be included in your program. All of you are familiar with the results which have been gotten on one item, the roaster.

Programs featuring only traffic or table appliances should be held from time to time. Reports show that these schools are very successful. A novel presentation is a skit with the home economist and one other woman participating. A brief outline will be all that is necessary for any one of you to work out your own program.

The scene will be the dining-room of a bride's home. A large table is in the center of the stage with wedding gifts of many electric appliances, silver, and dishes upon it. As the scene opens, the bride stands admiring them but wondering aloud how she will use them and where she will store them. The bell rings and the utility home economist enters, stating that she has called to see if she can be of any help in instructing her about the use of her electrical gifts and offering to demonstrate them. The bride assures her that she can. They proceed with the demonstration of each appliance and close by setting the table for dinner, arranging the appliances in their proper places. The home economist has offered many suggestions for their use and care during the demonstration.

When concentrating on the demonstration of any single appliance as often happens during the campaign, think of all the uses for which it can be used. For example, when demonstrating the coffee maker show that it makes the best coffee ever, that the lower bowl can be used to heat soup, prepare cocoa, boil eggs, or re-heat foods in small quantities. When demonstrating a grill remember that it will grill bacon and small steaks, fry eggs and a half a dozen other foods; that waffle irons bake 48 different kinds of waffles.

The minimum bill customer often does not have the buying power for many appliances. Let us teach her that each appliance can be adapted to many

uses and in doing so give her greater service for the money she has spent. This naturally results in greater load.

I will mention only one more appliance, the roaster. A demonstration of this appliance can be as elaborate as one has space and roasters with which to work. A recent suggestion from one manufacturer is a display of 18 foods for either a floor demonstration, window display or cooking school. This display includes roast turkey or ham, a complete meal, three loaves of bread, loaf cake, two layers of cake, pie, a sheet of cookies and one of biscuits, griddle cakes and broiled meats. It is not necessary to have 18 used roasters on hand when the demonstration is over as all foods can be prepared in two or three roasters if there is time to do so in advance. They are then just placed in new roasters for display.

We should consider displays also. Home service girls can help greatly by seeing that traffic appliances are given enough space on the sales floors of the dealer or their own company. Too often you find them in cartons tucked away under some counter or in the store room and an effective display made only during the campaign.

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Economics of Home Service

By R. HALL
B. C. Electric Railway Co.

WE MUST all understand that the electrical industry is a unique business, and fortunately or unfortunately, electricity cannot be served to our customers like other products. We pour it into our customers' homes through two or three wires, then tell them to go ahead and use it—it's cheap—but, until some one sells them some appliance that will use electrical energy, neither the customer nor ourselves gain any benefit.

The manufacturer has made a splendid job of selling everything electrical, and his obligation is complete when these articles are sold. It is there that the power company's responsibility commences, and this is their responsibility as long as that apparatus is in use. Whether the manufacturer should accept some of this responsibility is questionable. He hasn't—so the job is ours.

The development of the electric range made necessary home service departments and that was practically all they primarily started out to take care of—to show our customers how to most effectively and economically use this new cooking device. Today this is only a very small part of the home service department's duty. We now have refrigerators, cleaners, washers, ironers, etc. and perhaps more important than all others is the addition of home lighting.

The question of economics in the operation of these services should be:

1. Is such a service necessary?
2. If necessary, how far should the service be extended?
3. The type of personnel responsible for this service, and their training.
4. Can personnel be trained to be efficient in all services?

Is Such a Service Necessary?

The answer to this question is definitely "yes."

We can all remember the first car we owned. Not one of us could have stepped into one without at least being told how to start and stop the machine; and, notwithstanding years of experience in driving a car, you would at least require that much information on your 1938 model. Lack of knowledge as to the correct use of electrical appliances is not as hazardous—granted, but our customer should know, at least, how to get the most value from them. Our new knowledge of the correct use of light gives us the opportunity we needed — a real reason for customer contact. To have lamps and appliances sold to our customers is not enough, we must be sure that they are used efficiently.

Type of Personnel and Training

Experience has proven that women are suited for the work provided they are trained correctly. This does not mean that their knowledge is complete with a domestic science training. Today that should be only a small portion of their knowledge.

Also experience has proven that women of mature age are preferable. There are three reasons why they should be mature: first, central station work necessitates many years' experience to understand it thoroughly and requires much that can only be obtained through long association with the work; second, the constant turn-over of staff is not only extremely wasteful and costly, but is inefficient and harmful to the service. Some companies require that the age minimum for this work should be 30 years; third, customer acceptance is better from mature Home Service women.

Can Personnel Be Trained to Be Efficient in All Services?

Personally, the writer does not believe that at this early stage of extended home service work all these services can be effectively given by one person. Her early training may have been in domestic science; if so, it is only reasonable to assume that her interest would be directed with these appliances that have to do with the preparation of food. Should the training have been in lighting, it can be assumed that lighting would predominate. I believe in the larger communities that the services are better rendered when the personnel are trained for one particular service.

In rural areas it is possible that effective service in all branches of home service work can be given by one person. The reasons for this are that appointments are easier to obtain, and that the rural customer does not receive so many requests for interviews as does the city dweller.

Home service work and its personnel should receive the whole-hearted support of all executives, and, while the economics of any activity are important, in this particular work they should be of secondary consideration.

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Training Home Service Workers

By LUCILLE RAMIREZ
The Washington Water Power Co.

CHOICE and training of home service workers is of the utmost importance to the success of any home service department.

Experience has taught that women must be found for the positions rather than positions for the women. Our standard of qualifications is of necessity rather idealistic, though we realize that seldom, if ever, will a person be found with all the qualifications of an ideal home service advisor. We look for women of intelligence and education, with the ability and desire to be sympathetic and understanding, with tolerance and a saving sense of humor, with the willingness to work sincerely and untiringly for the satisfaction of customers and benefit of employers. Women who are attractive in appearance, who have poise, and the ability to judge human nature, who have determination and self confidence, the faculty for inspiring confidence in other people and the three graces—vitality, enthusiasm, and personality. When we have found women with a fair percentage of these attributes and a home economics diploma we set about to fill in along necessary lines, for they must have a thorough knowledge of electric equipment as well as a good command of the English language. They must be able to speak in public, write newspaper articles, if necessary, and speak

intelligently concerning their company's policies as the occasion arises.

When a woman is accepted for home service position in our company, she comes to us with the understanding that she is on probation for a period, of six weeks. She knows that she will receive her salary while she is in training, and that at the end of this time if she is not satisfactory to the company, or if she feels for any reason that she is not in the right type of work, employment by the company is terminated.

The Washington Water Power Co. adopted, several years ago, the all service home service program, which combines, throughout the year, lighting and all electrical equipment activities. Of necessity our training is divided to cover these activities—the selling of electrical equipment and home lighting. We believe that selling the *use* of all services is more profitable than direct selling, therefore, we incorporate this idea strongly in our training program.

In our home service department, the home service director supervises the entire department, as well as the training in salesmanship of electric cookery and appliances for which the LaSalle course in electric cookery is used. The lighting supervisor trains the women for the selling of home lighting, and the La Salle course is also used for this branch of training. The women are thoroughly schooled in details of both of these phases of home service.

A great deal of theory without the opportunity for practical application and experiment leaves one confused, and somewhat at a loss. To overcome any possibility of such a condition with our workers, the company has supplied our department with a most attractive and completely equipped laboratory. This laboratory, we planned ourselves to satisfy our needs in training home service workers, in testing recipes, equipment, and other purposes. It provides individual working space for each person and makes it possible, too, for every worker to have complete practical experience. It is, also, an ideal place for salesmen or dealers' training classes.

When each woman has mastered the use of all equipment, she is placed on the sales floor, where she secures practical experience in salesmanship. This procedure familiarizes her with the merchandising of appliances, company policies, and selling practices, and develops her confidence in her own ability. Part of her time is given to the demonstration of appliances in the model living room, step-saving kitchen and laundry which we have installed on our sales floor. It is interesting to note, that this innovation has been a source of intense public interest. The most popular room is the step-saving kitchen, which has inspired many housewives to remodel their old work-a-day kitchen.

By the time a home service worker has spent from one to two weeks on the sales floor, she is usually ready for the next step in her training, which takes her into the homes of customers with regular accepted advisors as they make their service calls of kit, range, or other equipment demonstrations. In these calls she observes and cooperates in every way possible. She also assists with the demonstration in lighting or cooking before school or club groups. The advisors are a great help to each other in exchanging ideas, and the new member of the group, as she works in, may capitalize on the experience of the others.

When training is completed, we expect a Home Service advisor to be able to take charge of a cooking demonstration, to conduct classes or to take over any part of the work as the need arises. To this end her training is diversified to be complete.

At the present time, we are experimenting a little with the advisors in our suburban territories. Naturally, when one remains in one locality year after year, one inevitably gets into a rut. Our plan is gradually to bring the advisors from the suburban town and replace them, temporarily, with those who have been working in the city. This makes for broader experience and diversified interest, which cannot but be helpful in the development of both advisors.

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Dividends from Cooking Schools

By CULA BUKER
Edison General Electric Appliance Co.

THE PURPOSE of a newspaper school is, first, to mold public opinion for the acceptance of electric cookery and the all electric kitchen, and secondly, to sell electrical equipment. A school which will pay dividends for our companies must, of necessity, be sales promotional. Your companies have electricity to sell and we manufacturers make equipment to use your electric heat. Each program, the lecture demonstration, display and publicity are all aimed at selling equipment which in turn will sell electricity.

Participating in this sales school will be the utility, perhaps the other electrical dealers who are promoting the sale of electricity for you, the newspaper and the advertisers. In order to have a successful school, everyone participating must be satisfied regarding the expenses. The public must come and talk about the school so that sales will follow.

From the viewpoint of the newspaper, it is a service to their subscribers, to local advertisers and gives the newspapers additional lineage and profit because of free service of the manufacturer's home economist. From the viewpoint of the utility and dealers, the school is to sell electric kitchen equipment. A campaign is perhaps all set and ready to be launched, and to get a big new prospect list, they must have chosen the newspaper which goes into the most homes.

The advertisers are necessary and important because they share in the expenses, furnish prizes, and in general share responsibility. More publicity is given to the school because of their participations.

The publicity given a school is very important. Plans must be made months in advance if national advertisers are to be hoped for. Checking and rechecking will be required, even though the newspaper is handling all publicity. Publicity should break ten days in advance and should build up the school. If it is a yearly event, the build-up will be comparatively easy.

Additional and free publicity can be gained by working through civic groups, and teachers, either by having them sponsor contests or by group attendance prizes.

Daily publicity should be given during the school. A reporter should be assigned for the days of the school. You want the news and progress of the school reported, the equipment, stage appointments and human interest stories written so that interest will be created and the attendance will be increased. Special features can be built up by telling them that a picture will be taken of the group tomorrow, either of the crowd waiting to get in or the audience. Free parking space for guests of the school, and a free nursery close at hand will also be a means of larger attendance.

The newspaper must be constantly reminded of prizes and their need is urgent. There should be major prizes as their pulling power is evident. Major prizes should be secured for daily attendance as well as for the final session with minor prizes and baskets for daily use.

The electric cookery program is further advertising for the school. Printed programs can carry a picture of an all electric kitchen or any one piece of electrical equipment. Prepare your copy carefully and check the proof,

for as we all know, a misprinted recipe is worse than no recipe at all.

Banners on street cars, buses, and company trucks can and have been successfully used. Window cards in downtown store windows of cooperating advertisers are of value during the school.

Choosing the auditorium is the newspaper's responsibility. It should be the best theatre or auditorium in town, clean, comfortable and popular. Morning, afternoon or evening sessions can be scheduled with approximately two hours at a session. We find that Tuesday to Friday are the best days of the week for attendance.

Sufficient man power will be needed during the school to fill baskets and deliver prizes. Ushers will be needed to pass out registration cards, promotional literature and electric cookery programs. These ushers may be salesmen, club women from a cooperating group, girl scouts, or school girls.

Entertainment may be varied as to local conditions. A master of ceremonies welcomes the crowd and radiates enthusiasm about the kitchen school. He should be familiar with the program, introduce the home economist, give the prizes, tell what will happen tomorrow and relate amusing human interest stories.

Contests may be conducted for the last day of the school—cake, recipe, essays, etc. These bring publicity for the newspaper, and lend general interest particularly if you secure judges of unquestionable prominence. Rules should be printed, publicized and mentioned in the school.

Registration of those attending is valuable to your company since you are creating prospects. This registration, perhaps a separate card, or a part of the program, should include information valuable to a prospect list — name, address, phone, equipment listed to be checked for kind being used, years of service, and equipment desired.

Your salesmen must make use of these registrations, or your school is only partly valuable. You have created the interest in electric cookery and kitchen equipment and the desire to possess it. They should finish the job. If a sales campaign is to follow, special inducements to buy now are usually offered for a limited time and can be publicized.

In building your program for your platform appearance, remember that primarily you are selling features of an electric range, refrigerator, electric kitchen, etc. not "glorified hash" or baking powder biscuits. Your program must be built to give you the opportunity to tell the story of your equipment — each feature — and its value. Foods are used to prove the value of each feature of the equipment, and so, interesting recipes can be used to attract attention.

Your cookery program will be based on:

1. Length of time on platform. Open and close on time with foods always finished cooking.
2. Enough equipment for foods to be cooked, planning time and temperature for each cooking space.
3. Do all mixing and preparation ahead of time unless you want to prove something by doing it on the platform.
4. Appear unhurried, yet have work going like clock work. Plan foods according to amount of watching necessary. You can be only one place at a time.
5. Make written time schedule for foods, their sequence, time off and on, and point to be proved. That idea will help women in planning their work and meals.
6. Let your assistant prepare foods for display, if it requires much time. Attractively displayed foods are more valuable for a sale. Prepare garnishes ahead of time.
7. Have plans made for display table and women to help get food there quickly, with provision for cartons, paper bags, waxpaper and plates on which prize foods can be taken away.
8. Each advertiser's story must be told convincingly. Plan when to use it at a conspicuous moment as the product is being used.

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Sales Promotion Through Dealers

By EMMA STATES
Puget Sound Power and Light Co.

AN EFFECTIVE piece of work has been done by the Puget Sound Power & Light Co. in its dealer contact work. It has meant a more friendly spirit between the utility and the dealer, and this in turn has meant more kw.-hr. in the utility load. This work has been along the following lines:

1. Educating range dealers in the advantages of electric cookery over other types of fuel.
2. Educating lamp salespeople in the advantages of Better Light for Better Sight.
3. Conducting promotional sales in small electrical equipment.
4. Maintaining the services of a dealer contact man.

In working with the range dealer we found it valuable to hold cooking schools for salesmen and servicemen, at which time the advantages of electrical cookery were presented. We tried to make selling easy by forgetting the gadgets on the range except where they offered sales appeal. We talked, instead, of definite outstanding advantages that electrical cookery presented.

Because they were working with the ranges that they would be called on to service in the field, the servicemen were instructed on various factors contributing to unsatisfactory results and means of clearing them. This also was important to the salesmen, as complaints often come to the salespeople, and if they knew how to correct the trouble, service calls could very often be eliminated.

The classes were held immediately following the closing of the stores and the food was prepared and served. We made no attempt to have a balanced meal, but prepared foods that would best demonstrate the ranges. In the class the men were invited to participate in the range operation so that they would actually know what was being done and learn to do it themselves. The food for the meals was provided by the dealers and the electric company provided the place for the meeting, the electricity and the home service instructor.

If the range was equipped with a thrift cooker, we arranged a complete meal to be cooked to show the capacity, the utility and the economy of operation of the feature.

The ovens of the ranges were demonstrated for capacity, the automatic features for leisure hours for the homemaker while the range did the work. We emphasized uniform results, elimination of failures which are expensive and showed the ease with which meals could be prepared.

Surface cookery was done to show the speed of the new electric ranges and to bring out the healthful qualities of the food prepared because of the controlled surface units which permitted the use of small quantities of water for the cooking process.

Broiling was done to prove that a successful job could be done with the higher wattage oven units with a minimum amount of smoke in the kitchen.

In oven cookery, roasting was done by the low temperature method. During the preparation of the meal or the roasting, the pilot lights were watched by the salesmen and a check made on the cooking time so that cooking costs could be computed.

One surprising thing of the demonstration was the lack of knowledge which the salesmen and even the dealers had about their products, and the knowledge given them was of vital importance in making satisfactory sales. We found these classes very beneficial

and did much to promote a feeling of good will between the utility and dealer and resulted in more electric ranges being connected on our lines.

During recent months the idea of selling electrical equipment as a complete unit for the kitchen has brought about kitchen planning departments, not only with electrical companies but with companies building kitchen cabinets, and this is another feature of dealer cooperation which has been effectively promoted by the public utility. The kitchen planning department lays out a complete kitchen with measured spaces for various items which can be added at any time. Thought is given to the proper position of work centers in order to eliminate waste steps in meal preparation. Proper lighting is designed to give ample light for work centers, and this not only gives a more satisfactory kitchen, but again gives us an opportunity for cooperation with fixture dealers.

In the promotion of the idea of Better Light-Better Sight it was necessary to carry on considerable educational work, as it is with any new idea which must be pioneered. This work was first done by lighting advisors who were thoroughly trained in the science of seeing. But no matter how good a recommendation on lighting was made, the cooperation of the dealer was essential, and we found it necessary to educate the sales personnel in department and furniture stores. We had to sell the lamp department buyers, for what good would our talks do if the buyer did not cooperate?

The next step was to see that every sales woman in the department knew the advantages of better lamps and better lighting. This work was done both in groups and by individual instruction. General talks were given before sales groups and were followed by more detailed instruction to individuals.

This presented only the ground work for the better light idea. Each year we conduct special contests in cooperation with the dealer to help him promote the sale of scientifically correct lamps. Special window display contests have been conducted, for which cash prizes have been given. For the duration of the contest, which was over a period of ten weeks, the lighting representatives called on the dealers once a week to help in the promotion of sales or offer any assistance that could be given.

In some districts the lighting representatives conducted dealer meetings so that they would understand why the I.E.S. lamp was better than the old fashioned lamp.

Dealer cooperation is carried on whenever a new electrical appliance is introduced. When I.E.S. lamps first came on the market, our company did the promotional work, conducted the advertising campaign and created the market by creating a desire for the commodity. After the promotional work was established, we closed out on the equipment and referred our customers to the retail outlets. The electric roaster was another item that was introduced and promoted by us, and after a demand had been created, we withdrew in favor of the dealer.

As promotional ideas cannot always be in full swing, our fourth means of cooperating with the dealer is by maintaining a dealer contact man. This contact man works to create a friendly feeling between the dealer and the utility by ironing out any troubles before they reach disturbing proportions. He also occasionally assists the dealer's salesmen on difficult sales. In cases of range installations, we hire the electrician to do the wiring, giving the dealer the advantage of the contract prices we have with the wiring contractor.

All special offers we have for our customers are passed on to the dealers. When service problems arise which dealers do not know how to handle, we assist in solving them through our service and home service departments. Our contact man makes routine calls on the dealers in the city, making on an average of thirty-five calls a week. Further, we service the ranges on our lines free, with the dealer supplying parts when necessary.

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Home Service Builds Load

By JAMES B. BUMAN
Northwestern Electric Co.

WE, AS utility people, rightfully believe that "Electricity Does so Much and Costs so Little" because we are its chief sponsors. To obtain approval of any large percentage of our customers is a constantly recurring task that is the responsibility assigned particularly to the sales department. The task involves not only sustaining the statement with the customer under present circumstances, but of expanding the use of electric service in the home as a greater servant to do much more and still cost little.

To quite an extent this can be done efficiently and thoroughly through the sales staff and various types of advertising media. But these two facilities cannot make the coverage that properly meets all the conditions that our service is required to render. They do not exactly bridge the gap with many customers who have used electric home servants perhaps for years and now fail to appreciate their value. Again they may have lost complete interest in an appliance. This happens from insufficient information on the device or it may be in need of some slight repair.

The numerous diversified uses of an appliance are often not brought out at the time of purchase. The home demonstration or discussion of the full value of the appliance in the actual realm of use often is more effective than the one at the counter before the sale. The mental defense against making a purchase is not apt to be evident. Certainly it is an ideal place to sow the seeds of desire in the customer's mind, so that less effort and expense is involved in the final selling of appliances. Rehabilitation of electric servants can best be done in the home with the housewife.

The normal course of advertising and the regular salesman are not in a position to unearth these hidden kw.-hr. in the home nor establish the good will and friendly customer relations that are sure to bring a definite result.

Thus we have found the need of a home service program in the utility business where other means of load development do not seem to reach.

It is important and essential that any home service program must be predicated upon fostering good will and friendly customer relations and at the same time, to be economically sound, must build load directly and indirectly for the company. All customer contacts by the home service girl must have as their motive improving the use of the company's service and to cement more satisfactory connections with the company. Calls that do not achieve this purpose at least in a small degree might better be left unmade because they are apt to be a waste of time for both parties, and occasionally leave a bad taste with the customer. Every call should be made with some specific objective in mind that will serve as a natural entree.

One company has shown that their residential customers have an average of nine appliances. If all these appliances continued their normal use, the average monthly revenue would be higher.

The revenue producing possibilities are almost too numerous to mention. They are usually in ideas hidden to the inexperienced and require skillful salesmanship to develop.

Too many appliances arrive on the top shelf from lack of friendly interest, after being in the home for awhile. It is the home service girl's duty to dust off such appliances; to create new customer enthusiasm by showing new ways

to enjoy them; to stress the economy of operation.

Not only are the older appliances, but frequently the newest devices, in partial use for lack of complete understanding. We have found the latest appliances popularly purchased, that are very practical and economical to use, later lying idle in the home. We have in mind the electric cooker, the roaster and the mixer. You can find these in the home, sidetracked, so to speak, because the housewife has the old beater still around and thinks the electric appliance costs too much or is too dangerous. She bought a roaster and it does not do what she wants, because she does not understand it. There is a wealth of kw.-hr. in small appliances that have been abandoned in the home for one reason or another.

Checking for unsolved mysteries of the electric range sometimes reveals that the housewife is discouraged trying to get satisfactory results in some particular respect. We find women who have simply quit making cakes because the oven does not perform properly. The range may be out of order mechanically. They may need just a few instructions in oven operations or surface cooking.

Here is an opportunity to do a real service for the customer, the company, and the dealer, since the range that does not function fully often stands in the way of other sales. Again, the home service girl can inject new enthusiasm into electric cookery, also suggest some new recipes for the whole family to enjoy and talk about.

The electric refrigerator offers another opportunity for customer appreciation and good will. New recipes in chilled dishes and frozen desserts, buying foods in larger quantity for economy, proper placement of foods on the shelves, cleaning the refrigerator, and care of the freezing unit—instruction in these features fosters friendly cooperation by the customer.

The water heater offers good load-building opportunities, particularly where the electric range is already installed. A short-cut to general home cleanliness with less labor is of keen interest to every housewife. Day and night hot water is the wish in every home, but they have to visualize it in terms of use and performance in their own home. Selling use from the customer's angle is the beginning of a water heater sale.

Home lighting is one of the most profitable fields for building substantial load and rendering a real service to the customer by the home service girl.

With a national educational program, and supported as it is by numerous coordinated interests favorable response may be obtained in almost every contact. In fact, many customers are waiting for a demonstration and practical knowledge of the meaning of Better Light-Better Sight activities.

The home service girl does not necessarily replace the home lighting girl, but it is important to utilize a customer call to the fullest advantage of both parties. She should be well trained in proper home lighting technique. Her training should include at least the fundamentals of interior decorating. Home lighting, if enthusiastically discussed with the customer, can make a lot of friends and bring much added revenue. In this field it is probably best to make special appointments so that ample time can be devoted to the customer's problems.

This paper has sought to deal only with the major load building possibilities of home service field work. It is of course vital that a representative learn the wisdom of company's policies, both general and sales, to establish complete accord between the customer and the company.

There is one remaining problem—giving due and fair credit to the home service girl for actual business developed. She accomplishes a great deal from a goodwill standpoint, which is often intangible. Rehabilitation of small appliances to use and creating the desire for additional ones is hard to evaluate in kw.-hr. on a daily report. The development of prospects for major appliances is more easy to trace for the final result.

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Better Light

Report of Home Lighting Committee*

By WALTER E. POTTER
Incandescent Lamp Dept., General Electric Co.

THAT "light for seeing" is only the beginning is evidenced by the progress during the past four years as the result of unprecedented home lighting promotion by the entire industry. The average home today consumes an estimated average of 350 kw.-hr. for lighting, whereas the same home with proper light conditioning will conservatively require for lighting alone 1,000 kw.-hr. This goal should be reached by 1947.

* Walter E. Potter, Incandescent Lamp Dept., General Electric Co., Chairman; B. C. Electric Railway Co., R. Hall; Mountain States Power Co., H. E. Ferris; Northwestern Electric Co., J. B. Buman; Pacific Power & Light Co., Geo. B. Bocarde; Portland General Electric Co., T. W. Fitch; Utah Power & Light Co., K. W. Browning; West Coast Power Co., C. A. Comstock; Westinghouse Electric & Manufacturing Co., G. F. Hain.

WALTER E. POTTER

The booklet "Light Conditioning" published by General Electric Co. shows how all types of homes can easily reach this goal. When the "average" home makes reasonable use of "light for seeing" throughout, kw.-hr. for lighting only will be trebled.

Sell High Wattage Lamps

It is interesting to note that gradually the average wattage per socket in the residential field has increased. An analysis by one of the Mazda lamp manufacturers in this territory shows that in 1936 the wattage sold was 69.3 watts, while in 1937 this has increased to 70.9 watts. The sale of 75 and 100-watt lamps shows a greater increase than 40 and 60-watt lamps. The "three-lite" group such as 50-100-150-watt and 100-200-300-watt increased over 60 per cent in 1937 over the previous year.

One utility reports that a survey of I.E.S. lamps placed in customers homes during previous years shows that in a vast number of cases these fixtures are now lamped in lower wattage than originally. In many cases as high as 40 per cent of these units have bulbs which do not give the customer the proper "light for seeing." Additional valuable work must be done by utilities and others in helping dealers to sell adequate size bulbs and lamps, aiding dealers to create effective displays and training the sales personnel to really sell light for seeing. This is a continuing job that must be done if we are to reach 1,000 kw.-hr. of residential lighting by 1947.

Manufacturers of I.E.S. lamps are developing new styles in design of a wide variety of types to meet all lighting conditions today. Artistic displays with window cards, tags, etc., are available to tie-in with increasing national consumer advertising. Utilities must plan to coordinate their efforts to make present national programs more productive by carrying through to the ultimate point of sales. Less than 3 per cent of the available market has been reached with I.E.S. lamp sales to date.

Whether utilities merchandise or not, all efforts must be stressed to develop a customer appreciation of good light-

ing. Home service departments should definitely assist in placing these units in customers homes. Better light for better seeing embraces not only I.E.S. lamps, but efficient lighting fixtures, lumiline units, decorative lighting, screw-in-type fixtures, such as the new low-priced, higher wattage units featuring the silver bowl lamp, Pin-It-Ups, garden lighting devices, etc. The price range of I.E.S. lamps has widened during the past year. Many lower priced I.E.S. lamps are now available through dealers. The merchandising of lighting equipment must be aggressively pushed for many years to come as all residential customers whether large or small can be sold additional light now, even though they cannot be sold other current consuming devices at the moment. No part of our electric service can produce greater results from both the utility and the consumer standpoints than lighting, when considered from the expenditure required on the part of the customer.

When it is considered that the national market for I.E.S. lamps is 100,000,000 and only 3 million have been sold since they were introduced until the end of 1937, it might be well for utilities to check more closely the sales figures reported by dealers in their respective territories.

At the home lighting sessions, considerable discussion was given to the use of adequate reports and records of the home service departments. It was felt that more complete tabulation of data should be acquired. Definite tangible results of the value of home lighting and home service can be secured if the proper study is made by each utility.

Closer cooperation with the rural sales departments can be given by the Home Service Department by training of rural service representatives on lighting as well as direct farmer contacts. This work has proven most profitable from a revenue angle as well better customer relations.

Home lighting work requires that all home service women on each and every home call keep these four objectives in mind:

1. Sell the low cost of present service.
2. Sell against decreased use of present services. Customer can get lower rates by increased use.
3. Sell use of newer devices.
4. Sell the utility to the customer as a proper, logical business in that community.

If these four points are completely sold to our customers on every home call by home lighting advisors, there will be no reason to question the value of any home service operation.

At the beginning of the electrical industry lighting service was number one —and it still is as judged by the following:

1. The one service undisputedly in common with all customers.
2. Lighting first, in order of necessity and man climbs up the ladder of civilization.
3. Pays for the highest "increment" net revenues.
4. Pays the highest percentage of revenue per kw.-hr. sales.
5. Is the very base and foundation of the entire electric load in the home.
6. Present foot-candle intensities are only the beginning as disclosed by the Science of Seeing.

Commercial and Industrial Sales Bureau†

Commercial Cooking

Report of Commercial Cooking Committee*

By D. A. RUNYARD
The California Oregon Power Co.

THE COMMITTEE'S conference in Medford held in conjunction with the general conference of the Commercial & Industrial Sales Bureau, took up the following subjects:

C. T. Bakeman told of the aims of the National Electric Cooking Council to promote cooking and baking equipment and service, disseminate sales ideas and methods, and advertising ideas, and suggested that our own Commercial Cooking Committee tie in with the national council and keep our Northwest utilities informed of that council's activity.

D. A. RUNYARD

In the absence of E. Tysoe (paper on Advertising presented herewith), the subject of advertising was discussed as follows:

C. T. Bakeman referred to efficacy of articles written for restaurant and bakery trade journals such as the "Western Baker." It was generally conceded that direct mail was the most effective type of advertising in this field, and there was general discussion on the possibility of working out a series of direct mail pieces to be syndicated among member companies leaving a space blank for local tie-up. P. T. Birchard stated that F. S. Lang Manufacturing Co. was preparing this type of mailing piece.

The use of travelling equipment displays was also shown to have been an effective medium, and O. C. Mayer outlined the results obtained from a restaurant operators' show put on by the manufacturer in cooperation with Idaho Power Co.

The methods of contacting customers more systematically was discussed by C. E. Hess, and the subject is likewise covered by a paper by E. Tysoe, printed below.

J. H. Shaw led the discussion on new developments in equipment and application, calling upon representatives of manufacturers and distributors to discuss their equipment. Much interest centered in the Edison dry food warming unit. It was brought out that these units produced a good load factor, and are admirably suited to demonstrate the value and cheapness of electric service. The Edison deep fat fry kettle has been installed in several places on trial without reverts.

Changes in the design of the grease

† A. H. Wegner, The Washington Water Power Co., Chairman; C. T. Bakeman, Puget Sound Power & Light Co., Vice Chairman; Chairman, Commercial Cooking Committee, D. A. Runyard, The California Oregon Power Co.; Chairman, Commercial & Industrial Lighting Committee, H. A. Olson, Incandescent Lamp Dept., General Electric Co.; Chairman, Industrial Power & Heating Committee, E. C. Branch, Puget Sound Power & Light Co.

* D. A. Runyard, The California Oregon Power Co., Chairman; B. C. Electric Railway Co., E. Tysoe; Idaho Power Co., O. C. Mayer; Northwestern Electric Co., D. O. Bergey; Pacific Power & Light Co., C. L. Jacklett; Portland General Electric Co., A. K. Gaylord; Puget Sound Power & Light Co., C. T. Bakeman, C. E. Hess; Utah Power & Light Co., J. Homer Shaw; Washington Gas & Electric Co., A. H. Labsop; The Washington Water Power Co., C. L. Hoffman, M. R. Lund.

trough of the Lang range were explained, and it was shown that the company's light duty griddles serve as good leaders to the sale of heavier and larger equipment.

A. K. Gaylord brought out that controlled heat of specialized electric equipment had changed the nature of the chef's duties. He is fast becoming a dietician rather than just a cook. The speed of the new inductive cooking equipment was also discussed.

The methods of justifying higher equipment installation and operating costs of electric service were fully brought out by M. R. Lund whose paper on "Intangible Values in Electric Cooking" is published below. Other papers bearing on this subject, "Advantages of Electricity Over Competitive Fuels," and "Operating Data on Commercial Cooking Equipment," have been submitted by E. Tysoe and are published below.

O. C. Mayer reported on methods of estimating operating costs before sales, and also on the use of written sales proposals.

A. K. Gaylord gave a progress report covering the joint committee on contests and data sheets in which D. O. Bergey is collaborating.

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Advertising

By E. TYSOE
B. C. Electric Railway Co.

AFTER reviewing reports from a number of member companies and summarizing the details available, we arrive at the conclusion that there are two forms of advertising most suitable and generally used to cover the commercial cooking field. These are (1) direct mail advertising and (2) personal advertising. Such other types of advertising as billboard and newspaper, both of which are expensive, are of very little value and are wasted as far as the great majority of potential customers are concerned.

Referring to direct-mail advertising, we are controlled primarily by whether the power company merchandises equipment or sells "service" only. Good advertising literature, broadsides and other forms of advertising literature, are gladly made available by the manufacturer at little or no cost; such literature can be used effectively by the "merchandising" company but must be used with discretion by the "service" company.

Personal advertising takes numerous forms and is effective in every way. We might classify it under three headings:

1. Signed recommendation letters and photographs of users of commercial electrical cooking equipment.

2. A personal letter from the power company commercial cooking representative recommending some new or special piece of equipment.

3. A personal contact recommendation. That is, have the prospect talk with an existing satisfied user.

When using the first "personal" method it is desirable to obtain a form of release from the person, or persons, whose name or picture is to be used, as a protection against possible legal trouble.

One distinct advantage in direct-mail advertising is that of being able to tie in with any campaigns which the manufacturers may plan from time to time.

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Customer Contact

By E. TYSOE
B. C. Electric Railway Co.

THE FOLLOWING set-up, which is somewhat in line with that already adopted by several companies, is suggested as the best customer contact vehicle:

1. In the business center served by the power company should be located one or more commercial cooking specialists. Their duty should be to contact commercial cooking or baking users of importance, say not less than once per month. The importance of keeping existing users satisfied cannot be stressed too highly. Further the representative should be responsible for service calls on all commercial cooking institutions within the city area at least once every six months. Any new data or literature available should be immediately placed in the hands of prospective customers by these specialists. The services of central district cooking specialist should be available to assist outside representatives on special installations only.

2. The central district will have also two or more representatives working on power and light. These men should have sufficient knowledge that they will be able to recognize some commercial cooking leads to be turned over to the central district specialist.

3. In outside districts for each area there will be a district manager. This man, in addition to his knowledge of extension work, light and power selling and appliance merchandising, should also have a working knowledge of commercial cooking. The various other sales representatives will work on light, power and cooking and will answer to the district manager who will assist wherever necessary in commercial cooking assignments. Should any special installation prospect be found, such as a large bakery or restaurant, then the services of the central district cooking specialist may be called for.

All district representatives will be assigned just so many customers that will allow for a service call at least once each year, more often if possible. Service calls are always of the greatest value from a customer goodwill standpoint.

In our proposed set-up it will be seen we have attempted to provide for total coverage of all the territory. It is just as important to cover the night club in the country as the restaurant on a city side street. These night clubs are potential users of a compact group of commercial cooking appliances.

It is possible that many power companies do not have a center heavy enough to stand the full time services of a commercial electric cooking specialist. Under such conditions it is suggested that a specialist be assigned certain special customers to handle such as: (1) civic accounts; (2) government accounts; (3) department stores and (4) chain stores. These customers require special attention in many ways and have been found to provide splendid opportunity in the field of air conditioning, refrigeration, heating and electric cooking.

It is not possible to make rules that could satisfactorily cover all companies. Conditions vary greatly and the foregoing details are only an outline to be used as the basis for further discussion.

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Intangible Values

By M. R. LUND
The Washington Water Power Co.

IN THE PAST too much time and energy has been spent in attempting to sell electric cooking by stressing the "tangible values" such as fuel or equipment costs instead of the "intangible values." We have talked about fuel cost, which is only a minor part of cooking costs, and have failed to make a sale because electric operating costs are generally 25 to 100 per cent higher than competitive fuels. We have talked about equipment costs and have also failed to make our sale because electric cooking equipment will cost 30 to 100 per cent more to install than competitive equipment.

However, when we talk about the "intangible values" of commercial electric cooking, we have a sales talk with a real story. This stressing of "intangible values" isn't anything new to the

restaurant owner because he hears it every day. The man who has sold him an electric sign costing hundreds of dollars has had to talk of the "intangible values" of the sign. The man who has sold him a modern store front has had to stress "intangible values." The restaurant owner will spend money for signs, new store fronts and so forth, but will continue to cook with old fashioned, unsafe and unsanitary cooking equipment until it falls apart, because he is not familiar with the "intangible values" of electric cooking equipment.

Therefore, let us forget the equipment and fuel costs of commercial cooking and stress the "intangible values" of electric cooking such as:

1. *Less space* — Valuable space is saved by the use of electric equipment because there is a minimum waste of cooking space which will permit the use of a smaller range. The elimination of fuel rooms, fuel oil tanks and chimneys.

2. *Low maintenance cost*—The maintenance on electric equipment is considerably less than that of other types.

3. *Air conditioning*—Electric cooking equipment will do many of the things we claim for air conditioning. It will eliminate excessive heat and dirt, thus resulting in a considerable saving in the purchase and operation of regular air conditioning equipment.

4. *Advertising value*—It has a definite advertising value because people always associate one important thing with the use of electrical equipment—sanitation.

5. *Less food spoilage*—There will be less food spoilage and better looking cooked and baked foods because of the uniform distribution and positive control of heat.

6. *Food saving*—There will be a material saving in the shrinkage of roasted meats—dependable authority sets these figures at a saving of at least 4 per cent.

7. *Improved working conditions*—Because of the absence of dirt, grease, smoke and intense heat, there will be a material saving in redecorating costs, cooking utensils and greatly improved working conditions. These will promote better working results and more contentment among employees.

8. *Fast, convenient and reliable*—Modern electric equipment is very fast heating and always ready.

9. *Longer life*—Because of its uniform heat distribution and lack of intense hot spots, electric commercial cooking equipment will last considerably longer than when using combustible fuels.

It is a proven fact that if we convince our customers of the above "intangible values" of electric cooking, we have little to fear from our competitors. So let us sell electric cooking results and not waste too much of our time trying to sell electric cooking on a kw.-hr. cost.

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Chief Advantages

By E. TYSOE
B. C. Electric Railway Co.

THE ADVANTAGES of electricity over competitive fuels are so well known to most of us and have been outlined in manufacturers' literature and other publications so many times, that it is rather difficult to give many new advantages. I shall here attempt to consolidate into one list the chief advantages in outline form, not necessarily, however, in order of importance.

1. *Reduced Labor and Labor Turnover*—No stoking, cleaning of burners and flues. No cleaning of pots and pans. Improved working conditions.

2. *Automatic Control*—Definite control of temperature and uniform heating conditions, resulting in savings in food materials, fuel and labor.

3. *Cleanliness*—Elimination of soot, grease, noxious gases and sulphur fumes incidental to use of fuel. Decoration of premises increased in life, all cooking utensils cleaner.

4. *Fire and Explosion*—Hazard totally eliminated.

5. *Cost of fuel*—Guaranteed as to price with a tendency in downward direction.

6. *Location*—Can often be placed in positions where fuel could not be used.

7. *Space* — Complete utilization of cooking space at correct temperature results in smaller equipment and less floor space. Complete elimination of space required for fuel storage.

8. *Heat* —Heat confined to areas where required, no waste, no overheating and overheated working quarters.

9. *Life of Equipment or Investment Charge*—While we are faced generally with a higher first cost for electric equipment, the life of equipment is from two to three times that of fuel fired equipment. Further the maintenance cost of electric equipment is comparatively low. As a consequence capitilization costs and can be spread over many years.

10. *Shrinkage of Meats*—All tests show a distinct saving in the shrinkage of meat when using electric heat with automatic control.

11. *Improved Products*—With fine electric cooking equipment and a good chef it is inevitable that the product will be of the best. This means the type of product that will bring the customer back.

12. *Ease of Operation*—The flexibility of electric heat with three heat and automatic control assures ease of operation and minimum attention.

13. *Food Stabilizing*—The new dry heat food storage tables have brought about a distinct advance in the art of food preparation. Stabilized heat means the correct temperature at which cooked foods, prepared in advance, can be maintained at the correct temperature without fear of further cooking, drying, or spoiling.

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Operating Data

By E. TYSOE
B. C. Electric Railway Co.

THE table below gives operating data and average use in several of the following classes of commercial establishments: (1) cafes, restaurants, lunch counters, and hotels; (2) bakeries; (3) institutes, such as hospitals and clubs; and (4) fraternity and sorority houses.

It will be noted that under the first heading for cooking loads up to 50 kw. the average runs about 100 kw.-hr. per kw. connected per month. The consumption per kw. on loads above 50 kw. is very much higher, seeming to indicate that a great deal more work can be turned out per kw. on heavy duty group installations.

Referring to bakeries, consumptions, as high as 200 kw.-hr. per kw.-month were encountered with the large installations. There is no exact figure that can be used for calculating purposes, the use per kw. being controlled by: (a) quantity of output, (b) class and weight of output, (c) type and quality of equipment, and (d) method of operating equipment.

Table I—Commercial Cooking Data

Connected Load	No. of Premises	Total Kw.-hr.	Average Kw.-hr. per Kw./mo.	Kw. Zone
1. Cafes, Restaurants, etc.				
385.09	28	41,500	108	Up to 20 Kw.
1231.72	37	115,850	94	From 20 to 50 Kw.
516.00	5	86,200	167	Over 50 Kw.
2. Bakeries.				
1850.73	32	325,525	176	All sizes from 6 to 377 Kw.
3. Institutions and Clubs.				
1144.71	23	107,535	94	All sizes
4. Fraternity and Sorority Houses.				
466	19	46,370	99.5	20 to 32 Kw.

Commercial and Industrial Lighting

Report of Committee*

By H. A. OLSON
Incandescent Lamp Department,
General Electric Co.

IN THAT part of the Medford conference of the Commercial & Industrial Sales Bureau devoted to lighting, the subjects indicated by the titles of the papers published herewith were discussed.

In addition to these subjects an attempt was made to gather from the representatives of the member companies present, figures that would illustrate the new commercial lighting load added in 1937. From the reports given at the conference, it is apparent that new E.A.R. from commercial & industrial lighting activities of the member companies of the association in 1937 amounted to a million and one-quarter dollars.

Another subject discussed at the conference but not reported in the form of a written paper was "Tools For the Lighting Salesman," by O. C. Mayer. In his presentation of this subject, Mr. Mayer demonstrated the lighting kit with its light meter and other equipment, literature that could be used, and the type of sales story that is effective.

In the discussion of "Opportunities in Industrial Lighting," by J. C. Plankinton, C. T. Bakeman brought out the fact that the Washington Department of Labor and Industries had written into its industrial safety code I.E.S standards of lighting. A. H. Wegner expressed the opinion that industrial power salesmen should pay more attention to the lighting in industrial plants.

In the discussion of the paper on the "Promotion of Street and Highway Lighting," by C. T. Bakeman and C. E. Hess, the importance of the support of civic clubs and political bodies was emphasized.

Commenting on A. H. Wegner's discussion of the "Written Sales Proposal for Selling Commercial Lighting," J. A. Lockhart pointed out that written sales proposals also had value as a method of training lighting salesmen.

Successful methods of soliciting office lighting, as presented by J. H. Shaw, were discussed and it was brought out that the building tenants can be made an important factor in inducing the building management to improve the lighting.

R. E. McDonough presented the subject "Solicitation of School Lighting," covered by the written paper of T. W. Fitch, who was not present. Mr. McDonough emphasized the desirability of working through P.T.A. groups whose interest could be easily aroused to the need of adequate lighting in schools by statistics on the harm caused by inadequate lighting.

In general it may be said that the interest of utilities, manufacturers, jobbers and dealers has been greatly stimulated since the development of the "Science of Seeing." A better job is being done each year through the cooperation of all interested parties, but, at the present time, only a beginning has been made in the business of raising levels of illumination to minimum conservative standards. Three to four times as much light as is now used will be required to reach these minimum standards. Lighting promotion should be number one on every utility program because of the great benefits to be derived by the users of electric light. Such a program means more equipment sold by the manufacturers, distributors and contractors; more wiring for the contractors, and the sale of more kw.-hr. by the utility companies.

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Industrial Lighting Opportunities

By J. C. PLANKINTON
Northwestern Electric Co.

LIGHTING conditions in most industrial plants are far below what is considered standard, not only from the standpoint of quantity of light, but as to quality and upkeep.

Levels of illumination—In a survey of over 2,900 industrial plants in 182 cities located in 22 states, it was found that the average lighting intensity was less than 3 foot-candles. A check of lighting conditions in the Portland area found lighting levels in industrial plants to average less than 7 foot-candles.

Poor distribution—In the majority of industrial plants there is to be found very poor distribution of lighting because of improper spacing of units. This condition results in spotty illumination and a very poor utilization of production space.

Lighting equipment—It would not entail a very exhaustive survey to determine that the lighting equipment in use in the majority of industrial plants today is very much out of date. It has very largely been purchased on a price basis without regard to its effectiveness in conserving and controlling light. We find bare lamps in use where the light output of the lamp is permitted to stray as it will, producing a glaring brilliance in the eyes of the workmen. It would seem just about as sensible to permit lighting one of the most important tools of industry, to go uncontrolled and inadequately used, as it would to expect a high priced, skilled mechanic to cut a steel gear with a hammer and cold chisel.

Wiring conditions—Seldom, if ever, do we find wiring capacity sufficient in an industrial plant to permit taking on any appreciable additional lighting load without increasing wiring capacity. More often a check will show wiring capacity insufficient to carry the present load.

Reflecting surfaces—The prevalence of dirt, smoke, grease-laden air and gases in industrial plants soon renders ineffective such reflecting surfaces as may be utilized for directing light. The general absence of paint on interior of industrial plants adds to the inefficiency of whatever lighting facilities may be in use.

Allied interests—Conditions, such as are pictured above, would seem a rather severe indictment of the several allied interests involved. Would it not be logical to expect real results to be accomplished through the concerted effort of such interests as wiring contractor, fixture manufacturer, jobber, and dealer, the paint man and the utility to bring to the industrial plant owner the benefits to be derived by improving the working conditions in his plant?

Need

The need for replacement of obsolete machinery is being constantly urged upon executives of industrial plants. However, lighting systems, as well as machinery and equipment, become obsolete. Improvements in lighting have come so rapidly that a system considered of the very best a few years ago, may be today so lacking in efficiency that its replacement should not be delayed.

Levels of illumination—Present day recommendations should be in the order of a minimum of 20 foot-candles of general illumination in working spaces, with localized lighting intensities of varying degrees, depending upon the severity of the seeing task; 5 foot-candles in aisles, passageways, elevator space, and storage rooms; 25 foot-

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candles of indirect lighting in office spaces.

To produce 20 foot-candles of intensity with direct lighting in the work area, there would be required the installation of approximately three watts per sq. ft. of floor space; and for 5 foot-candles in inactive area, approximately one watt per sq. ft.; while office space lighted with indirect equipment to an intensity of 25 foot-candles would call for at least five watts per sq. ft.

High priced machinery — Industrial plant owners are today putting more and more money into machinery wherein increased production is the only justification for the expenditure. It would follow, that the plant operator would be interested in improving the seeing conditions in his plant if he can be made to see that the production from his high priced machinery can be increased through the utilization of proper lighting.

Skilled employees—Likewise, the industrialist has invested large sums in skilled workmen and he would be agreeable to installing proper lighting for their use, provided one can prove to him that a greater return on the investment in these workmen is to be had when they are employed under proper lighting conditions.

Some Equipment Suggestions and New Developments

R.L.M. dome reflectors—An industrial lighting job properly engineered and installed, using R.L.M. dome reflectors, will give satisfactory results in the majority of plants.

Glass steel diffusers—In plants where a more efficient and somewhat higher priced installation may be justified, it is well to recommend the glass steel diffuser.

Westinghouse mill lite—This fixture, recently developed, embodies in addition to the several features of the glass steel difuser, features of safety, improved efficiency and durability.

Mercury vapor—For plant lighting where men work from blueprints, high intensity mercury vapor lighting has proven very adaptable. The peculiar color of lighting, resulting from the use of mercury vapor, brings out much more clearly the lines and dimension figures on blueprints.

Indirect lighting for industrial plant offices—It has been found advisable to install indirect lighting in plant offices where it is at all possible. When plant executives have become accustomed to the greater eye comfort to be had from this type of lighting, they are more willing to support an appeal to modernize general shop lighting.

Selling Methods

Selling industrial lighting offers no problem that is peculiar to this class of load development. Just as other selling effort, it calls for continuous, consistent application of sound selling principles. All presentations, whether oral or written, should follow Advantage, Proof, Action selling, wherein all advantages are directed toward the correct buying motive.

Advantages—1. The chief specific advantage of effective lighting for production is increased production efficiency. With higher levels of illumination the worker's vision becomes more accurate, and details may be seen more rapidly. Production peaks and valleys during the day are greatly lessened by improved lighting, and night-shift production, formerly lower than daytime production, has increased materially—often exceeding the daytime rate.

2. Lighting even helps to increase production of automatic machinery, for the machines must be attended and supervised, to some extent at least, by operators. When one operator tends several machines, he must be able to see operating conditions quickly and accurately; he must be able to work safely with rapidly moving mechanisms.

3. Another specific advantage is better supervision. The foreman can see all his operators and machines quickly and easily.

4. Lighting permits 24-hour operation. In many branches of industry today two or three shift operation is a necessity for lowering operating costs.

5. Effective lighting permits continued employment of thousands of workers who might otherwise be considered "too old." The benefits of their skill and experience are retained—and they keep their jobs.

6. Good lighting decreases spoilage and "rejects," thus reducing unit costs.

7. Modern lighting for industry helps maintain quality of production. Increased accuracy in both actual production and inspection of the product is a proved lighting result.

8. Lighting helps to prevent accidents. One authority estimates that poor lighting is the direct cause of 5 per cent of all these accidents and a contributing cause of 20 per cent. Records of industrial accidents show that, on the average, each disability costs the employer about $200, which represents compensation, doctor bills, and hospital fees. In addition, there are damaged machinery and materials, and other items that average in cost about four times the direct cost. In other words, the company loses about $1,000 on the average every time a worker suffers a disabling injury.

9. Effective lighting improves employee morale. Whether the workman realizes it or not, he is prejudiced against the dark, gloomy factory and in favor of the well-lighted plant.

10. Good lighting permits active productive use of every square foot of space. With spotty and inadequate lighting, a large part of the floor area is dark and useless for actual production, leaving much of the plant fit only for storage.

11. Improved lighting reduces maintenance costs. It takes more time to maintain and clean obsolete units than to care for modern equipment.

12. Tests in the lighting research laboratories show that it takes twice as long to see at 3 foot-candles than at a level of 25 foot-candles. Workmen who see faster can work faster and more accurately and, where accidents are concerned, split seconds count.

13. Good maintenance of lighting equipment is particularly important in the lighting-for-production field, since equipment becomes dirty, and walls and ceilings darken very easily in the average manufacturing plant. As much as one-half the light paid for is lost through lack of simple maintenance.

Proof of advantages—1. 'Before' and 'after' photographs of successful installations.

2. Testimonial letters of satisfied users.

3. Testimonials of experts in the field of lighting.

4. Trial installations with 'before' and 'after' records of results.

Action—The final action desired in any sales negotiation is receipt of the customer's order, which may reasonably be expected if sufficient advantages are presented, with proofs, upon which agreement is secured.

Small beginnings—One should not be discouraged at being given opportunity to install but a small portion of an industrial plant's improved lighting layout. Complete modernization will usually follow a small beginning, provided the initial installation is correctly designed and put in a well chosen section of the plant.

Employees appreciate good lighting—Employees are quick to express themselves not only to the management, but to fellow employees in other parts of the plant.

Written proposals—Proposals on all prospective loads of any importance should be presented in written form, again using advantage statement, proof and action form of report.

Load Development Possibilities

Within the scope of this report it will be possible to present only a few yardsticks by which one may approximate the load development possibilities on his system.

Average floor space per employee—From data gathered in a national survey, it was found that 564 sq. ft. of floor area is required per employee, 70 per cent of which is active working space and 30 per cent inactive space, such as elevator space, aisles, passageways, halls and storage area.

Using 20 foot-candles with 3 watts per sq. ft., we have a prospective connected load per employee for the active space, of 564 x .70 x 3, or 1184 watts; for 5 foot-candles with 1 watt per sq. ft. of inactive space, we have 564 x .30 x 1, or 169 watts per employee. Allowing 100 watts additional per employee, on the basis of 5 watts per square foot of office space, we have a total prospective load of 1453 watts per employee. Deducting the present load of not to exceed 450 watts per employee, we have, as a minimum estimate, a measure of 1000 watts additional lighting load per employee in the industrial plants on a given system.

Today we find an average expenditure for lighting service, in industrial plants, of only 3/10 of one per cent of the value of manufactured products. There should be real opportunity for selling the plant executive on the value to be received from the additional cost involved in providing lighting facilities adequate to the seeing task involved.

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Street and Highway Lighting

By C. T. BAKEMAN
and C. E. HESS
Puget Sound Power & Light Co.

IN REPORTING on the promotion of street and highway lighting we are covering the two subjects as one, as in reality there is very little difference. The need for each is fundamentally the same, the market is practically the same, we are selling to the same people and our methods of promotion must have the same fundamental elements.

The need for street and highway lighting and the need for our selling it can be found in a report by the National Resources Committee stating that adequate lighting should reasonably save at least 35 per cent of the night fatal accidents. This would mean 8,000 lives a year nationally to which must be added 80,000 injury accidents and approximately 160,000 cases of property damage that would be saved by adequate safety lighting.

A study by the insurance people indicates that safety lighting costing $4,000,000 a year would save 500 lives a year, 5000 injuries and 10,000 cases of property damage each year. This represents a total economic loss of approximately $60,000,000 a year that would be saved by adequate safety lighting. This is approximately the market for safety lighting in the Northwestern states.

STREET LIGHTING PLANNING SERVICE
Map of — STREET LIGHTING NEEDS
LEGEND
PRIMARY TRAFFIC SAFETY
SECONDARY TRAFFIC SAFETY
PRIMARY BUSINESS DEVELOPMENT
SECONDARY BUSINESS DEVELOPMENT
RESIDENTIAL LIGHTING
INDUSTRIAL LIGHTING
DANGEROUS INTERSECTIONS
DETAILED PLANS
A PROGRESSIVE STREET LIGHTING PLAN
MAIN STREET TOWN
THE NEED AND MARKET FOR SAFETY LIGHTING
SECONDARY ARTERIAL
TYPICAL SMALL TOWN
0 100 200 300 400 500 PER CENT
PREVIOUS LIGHTING - ON THE STREET
SAFETY LIGHTING INSTALLED
REVENUE
PRIMARY ARTERIAL
TYPICAL METROPOLITAN CITY
PERCENT
0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000 2100 2200 2300
EXISTING LIGHTING ON THE STREET
SAFETY LIGHTING NEEDED - THE MARKET
MINIMUM I.E.S. CODE

Fig. 1 (above) and Fig. 2 (below)

A report from the Northwest companies shows a total of four highway lighting installations in the Northwest —one installation each in British Columbia, Washington, Oregon, and Utah. There are a few projected installations in each of these states and also in Montana. One ten-mile section of the Pacific Highway in Washington has averaged four night fatalities per year over a two year period. This adjoins a three mile section of lighted highway which has a two year record clear of any night fatalities or serious injuries.

It has been found that many utility men feel that there is very little more that can be done in the way of street lighting save perhaps a few ornamental installations in business districts. In fact many of us are inclined to think of street lighting sales just in terms of ornamental lighting sales. When we consider safety lighting as an essential to traffic safety, we enlarge our market to a different kind of lighting and to the entire town, city, county and state. I would suggest that you analyze one or two of the typical towns you serve, consider the entire town and compare the existing lighting with the minimum safety lighting standards established in the Illuminating Engineering Society of Street Lighting.

Chart 1 illustrates a study of a typical town of under 1,000 population that had a fair lighting system on its business street through which ran a secondary state highway. Safety lighting installed in this town increased the lighting on the street to just 400 per cent of what it had been, and the revenue was more than doubled. This safety lighting is now projected to cover the entire length of the street rather than just the business section. Just one life saved on this street will pay for the town's entire street lighting bill for over five years, to say nothing of the other savings and advantages.

This chart shows a safety lighting analysis of a typical primary arterial in a northwest Metropolitan city prepared by an I.E.S committee. This city once had the reputation of having one of the best street lighting installations in the country and yet this arterial has less than 5 per cent of the light on the roadway required by I.E.S standards for safety. This same arterial has accounted for 28 fatalities and many more

injuries in the six years it was built, the majority occuring at night.

This chart gives you a cross section of the need and the market for safety lighting. In fact, back of this picture is more than a sales opportunity. There is a definite social and moral obligation. We know the facts that will help save many unnecessary deaths and unless we bring these fatcs to the people and to their officials, we cannot but share in the responsibility of these deaths. This responsibility is not limited to the territory of one company. The people to whom we are responsible are represented primarily through state officials on matters of street and highway safety so I propose to you that this matter of night traffic safety is a regional obligation which we should share here in this group.

Fundamentally, our customers for safety lighting are all of the people. All of the people will pay for this service, all of the people pay heavily up to the point of life itself for lack of safety lighting. No utility can gain its share of appreciation for safety street and highway lighting unless most of the people realize its value. No public official can justify spending tax money unless he is convinced of the need and value of safety lighting and unless the people appreciate this value. The fundamental part of our responsibility for night traffic safety is to see that the people have the facts. Our educational program on night accidents and traffic safety should cover first, education among company employees; next, public officials and safety organizations; and finally, the public.

When these groups realize the facts about night traffic accidents and the need for safety lighting, our responsibility becomes one of advisory service. Before we can advise we must know our subject thoroughly. It is desirable to have at least one man in each company thoroughly informed on modern research and street lighting design. This man's first job should be one of education of all company employees from the line foreman on up so that effective installations will be obtained.

The first step in safety lighting advice is to determine where the first installations should be made. For this I suggest a planning service that will provide an overall picture of the safety lighting needs. Chart 2 shows such planning service worked out for a typical small town. This is done in cooperation with the traffic or safety officials concerned. Please notice that it includes a complete picture of the street lighting needs, that it clearly indicates the first and most pressing needs and that it lends itself to a progressive program of improvements. This same plan can be adapted to a large city or a state highway system.

The next step in advisory service is a design and complete layout covering the first and most important improvement. This may cover a single dangerous intersection, one block or an entire arterial. In either case this design should be carefully worked out. It is best to light adequately one intersection than merely increase the wattage of existing fixtures on an entire street, even though the latter may mean more immediate revenue.

The next step is to prove that your design for this initial installation is the one that should be installed. If the city wants safety street lighting and has the funds for this initial installation there can be no better proof than a trial installation.

This plan is a practical one and experience shows that it will work. I am going to call on C. E. Hess to tell us of his experiences and some of the preliminary results, in applying this plan in Everett, Wash.

Promotion of Street and Highway Lighting

Before describing the results of our experiences on lighting for safety in one city, Everett, it might be well to review the safety lighting program as outlined and followed by my company. This will illustrate that safety lighting is not an overnight program, and that by patience and hard work it will produce results.

In January 1936 the program was initiated by Mr. Bakeman, within the company. It was six months later, in June that we began the education of the company organization, that is, district managers, superintendents, local managers, and all others whose cooperation might be needed in order to guarantee the success of such a movement.

The next step was undertaken in January 1937, when we began making traffic safety presentations to public officials and safety organizations. including chambers of commerce, civic clubs, and P.T.A's. In these presentations we stressed all other traffic safety measures as well as lighting. This was done through talks before clubs and the use of visualizer films. Six months is not too long a time for this phase of the program.

It was not until June of 1937 that the actual work which was to show results got started. It was then that the street lighting planning service was offered to the cities. Here we approached the city officials with the offer of presenting a long time "planned" program of lighting the entire city or town for safety, including traffic and protection to property. The city was divided into sections with the arterials and other danger points emphasized. The idea, of course, in this was to give a sales approach for an immediate and definite start. As a result of the year and a half of ground work the cities were anxious to take advantage of this service and the following results for the last six months of 1937 speak for themselves.

Street lighting, city plans presented..	15
Individual street lighting layouts prepared	24
Trial installations made.	9
Safety lighting installations sold.	12
Other street lighting increases.	15
Total additional annual revenue obtained	$7261.00
Progressive programs under way in 1938	16

There are some important "don'ts" in carrying out such a program. In the trial installation don't scatter a few lighting units over too large an area or the effectiveness will be lost. Make the trial installation complete even though you may not expect to sell it as demonstrated. Don't be afraid of overselling; the danger is in underselling. Don't be afraid to mount the units high enough from the street, 22 to 25 ft. gives the best results.

In Everett we had, as do all towns, a death trap on one of our arterials, Everett Avenue, which runs east and west. It was the scene of 90 per cent of our night accidents. Due to the fact that it was adjacent to our business area, which was well lighted and due to the presence of brightly flood lighted service stations, visibility on the highway, which was comparatively dark, was very poor. On rainy nights it was impossible to see pedestrians at street intersections and consequently we had an ever increasing accident tool. In an attempt to reduce this hazard, the city officials requested a trial installation covering the eight blocks involved. At the time of the request the street was lighted with six 2,500-lumen and two 4,000-lumen center suspension radial wave reflectors. For the trial we installed 26 light directing units on short brackets, two 6,000-lumen at each street intersection and one 4,000-lumen at each alley, with the recommendation of an eventual arrangement of four 6,000-lumen at each street intersection and two 4,000-lumen at each alley, a total of 52 units. In view of later trials this was a mistake. The trial installation should have been to conform with what we felt should be the final arrangement. After the demonstration we could, if necessary, return to the 26 unit plan. The chances are the trial would have become a permanent installation. However, the city ordered us to leave the trial installation in as a permanent one. The results? Not a single

accident or near accident on Everett Avenue in the six months since it has been lighted for "Safety."

Since seeing the results of lighting a highway so that pedestrian traffic, as well as automobile traffic, entering the highway can be clearly seen under even the most adverse weather conditions, the city officials are planning two more installations for the year of 1938, one of 44 6,000-lumen light directing units, and a shorter on of nine 6,000-lumen light directing units. They also hope to better the lighting from a safety angle on another portion of Highway 99 through the use of sodium vapor.

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Lighting Sources

By WALTER E. POTTER
Incandescent Lamp Dept., G. E. Co.

MORE THAN a half billion large incandescent lamps were sold in the United States during 1937 establishing a new volume record. An interesting fact shows that the lamp wattage in both residential and commercial lighting has increased each year. In the Pacific Northwest one manufacturer reports that the average wattage per socket (eliminating street series, projection lamps and special bulbs) has increased from 69.7 watts in 1936 to 70.9 in 1937.

High efficiency Filament—Perfection of a new high efficiency tungsten filament which increases the light output of incandescent lamps ten per cent without using additional electric current was one of the outstanding improvements in the field of lighting during 1937. Taking a 60-watt lamp as an example, the tungsten wire is just drawn into a straight wire 19/10,000 of an in. in diameter, almost invisible to the naked eye. It is then wound 335 turns to the in. around a thin molybdenum wire, or mandrel, leaving the coils 1/1000 of an in. apart. The coils must be as close together as possible to reduce heat losses but must not touch each other. The coiled wire is coiled again on another mandrel 70 turns per in. The original tungsten wire is 20 in. long. The first coiling compresses it to a length of ¾ in.; the second, to a length of ⅝ of an in., with a coil diameter of 310/10,000 of an in. Following the second coiling, the mandrels are chemically dissolved. When installed, the filament is mounted as a cross-bar between two lead-in wires, with one support in the center of the filament instead of being looped around three supports as was the practice with this older type of coiled filament.

A new 300-watt incandescent lamp with a medium screw base has been developed to fill a need for a lamp of this wattage with short light-center length for use in fixtures now employing the 200-watt lamp. The new bulb has the same diameter as the present standard 300-watt lamp. The user should be cautioned not to substitute this new lamp for the 200-watt size where the glassware is so small that objectionable glare will result.

Silver Bowl—Considerable progress has been made with standard Mazda bulbs with a silver bowl. These units are available in wattages from 40-watts to 1000-watts, inclusive. Research has shown that this new lamp with a thin inside frost on the neck and a clear bowl with outside silvering has a high initial lumen output and good lumen maintenance throughout life. In general, silver bowl Mazda lamps are ideally suited to existing indirect installations which will benefit by reduction in reflector maintenance cost, to indirect fixtures with deteriorated reflecting surfaces, and to new installations where it is desirable to employ fixtures styled to harmonize with the newer architectural forms.

Bi-Post—To fill the need for high wattage light sources of small size and rugged construction there has been developed the 1000-watt and 750-watt medium bi-post base lamps and very recently the 500-watt medium bi-post base lamp equipped with tubular bulbs. Made of heat resisting hard glass, having extremely low thermal expansion characteristics, the lamps are resistant to bulb failure resulting from contact with rain, snow, sleet or occasional hail. Placed above the filament in the 1000-watt and 750-watt lamps is a "collector grid" which catches the blackening which otherwise would go to the wall of the glass bulb and interfere with the transmission of light. In the case of the 500-watt lamp, which has been designed for either base-up or base-down burning, there is a grid both above and below the filament. These lamps require a porcelain socket of special design to accommodate the bi-post prongs. They can be operated satisfactorily if tipped not more than 20 deg. from the vertical.

Photo Lamps—For use in photographic work there is the photoflood lamp for time exposures, and photoflash lamps for snapshots. The photoflood lamps operate from normal lighting socket voltage, having wattages (at 115 volts) from 250 to 2000 watts with initial lumen outputs from 8,650 to 65,000. The photoflood No. 1 has an efficiency of 34.5 lumens per watt. There are two new photoflash lamps. Mazda photoflash No. 7 is designed for news and general photography but its small size and longer period of flash will also appeal to the amateur. It is filled with fine aluminum wire and also contains a small piece of aluminum foil, made with guide-breaking filament it can be used with average synchronizer adjustment. It has an initial output of 22,500 lumen seconds.

Mazda photoflash No. 15 is similar in appearance to photoflash No. 10 but differs radically in performance. This is because the aluminum foil has been treated in a special way to lengthen the time of the flash and increase the accuracy of timing as well as the total light output of 30,00 lumen seconds. It also has a quick breaking filament and can be used with average synchronizer adjustment.

Flood-Flash Lamp—Still in the laboratory development stage is a new unit which offers many possibilities in the future. This flood-flash lamp is really a bulb within a bulb, of the high intensity mercury type, consuming approximately 100 watts with an additional 15 watts in the reactance operating on a. c. To be used in photography, when first turned on the arc strikes, emitting a feeble bluish glow, which takes about 5 minutes to warm up to a brilliant stream of light by which the photographer does his focusing. When ready to "shoot" the picture, the reactance is shortened out by a suitable control mechanism permitting a flow of about 60 amperes and increasing the light output from about 3,000 lumens to 400,000 lumens. In addition to the reactance control mechanism, there is a device which permits the current to be kept on for intervals ranging from ½ cycle to about 7 cycles, thus controlling exposure. This unit has a peak brilliance of 500,000 lumens in 1/60 of a second. A single flash of 1/20 of a second equals 5 watt-hours.

250 and 400-watt High Intensity Mercury Lamps—During the past year, we have seen many installations requiring high levels of illumination obtained by the 250-watt and 400-watt high intensity mercury lamps. Industrial lighting both in high and low bay where the mercury lamp has been used alone, or in combination with incandescent Mazda lamps in the same fixture, has proven satisfactory. Alternate Mazda and mercury units are acceptable. Armories and gymnasiums have used mercury alone on high mountings. Many offices, including drafting rooms, lend themselves admirably to mercury lighting especially where present wiring does not permit the use of higher wattages to obtain greater footcandles.

100-watt High Intensity Mercury Lamp—To replace the 85-watt, type H-3 lamp, the 100-watt, H-4 lamp has

been introduced. This unit has a lower starting voltage of 250 with an operating voltage of 130. When the lamp is up to full brilliancy the pressure in the arc tube of quartz is only 8/10 atmospheres as against 25/30 in the type H-3 lamp. The initial light output is about 3,000 lumens. Allowing for the loss in required ballast transformer, the overall efficiency is about 26 lumens per watt. A new socket is being developed as the base is the same as on the S-2 Sunlamp, now called admedium. The arc stream has a length of about ½ in. and a diameter of approximately 1/16 in. with a maximum brightness of about 6,000 candles per sq. in. This lamp offers itself in a field where a small and extremely brilliant light source is required. It has also been found to be desirable for fluorescent effects.

Fluorescent Lamps—The development of fluorescent lamps has created considerable interest during recent years. It is hoped that some type will be available during the coming World's Fair in New York and San Francisco in 1939. Many modifications may be made for the lamps are eventually to be standardized. Present indications point to a tubular bulb similar to lumiline with length of 18 in. and 24 in. and diameter of 1 in. and 1½ in. with approximate lamp wattage of 15. The light output of these lamps (based on white light) is approximately 300 lumens per foot. Within the bulb is a trace of mercury and a small amount of argon at low pressure which acts as a starter between two tungsten electrodes. A special fluorescent powder is coated on the inner surface of the glass. The invisible ultraviolet radiation strikes the fluorescent coating and is transformed into visible radiation of colored light.

Display and Store Lighting—Among the many interesting trends in the rapidly developing field of luminous structures and displays is the use of modern material with stable reflecting surfaces to multiply the effectiveness of exposed sources. Glass blocks variously illuminated, and structural sheet glasses of interesting texture and color, some of the tempered variety, are adding new and important values as are metal surfaces.

A wholly adequate glare free method of triplicate mirror lighting has been developed. The reflector is a parabolic trough made of polished "alcoa" lighting sheet with a double ended socket located so that the light centers are on the focal axis. Since one stands under the reflector, no light sources are in the field of vision. The light from the reflector strikes the mirror at such angles that it is directed to the lower half of the figure, permitting uniformly easy seeing of all details.

The first application of a louvred direct-lighting unit provides a relatively high level of down-lighting, but with a wide distribution suitable for general illumination. The unit is a shallow, semi-spherical, etched, aluminum spinning, recessed flush with the ceiling. It is equipped with either translucent or opaque concentric ring louvres, with a secondary projecting reflector to direct some light to the surrounding ceiling area for relief of brightness contrast. The unit can use either an inside frosted lamp with a reflecting cup or a silver bowl lamp.

Large Glass Blocks—An example of the possibilities of lighting effects to be obtained is demonstrated here with various circuits of colored lights behind a one foot square, glass block, when the light sources can be turned at various angles (up to 90 deg.) giving us myriads of interesting patterns. Small light sources may be used such as lumiline lamps, low wattage bulbs and Climax units.

Color Filters for Fruit Inspection—Much progress has been made in the use of special color filters giving various light emanations for sorting citrus fruits, visual inspections for red scale on lemons, black rot on prunes.

Grain-O-Wheat Lamp—The bulb of this little lamp is a tube about 2 mm. in diameter and 8.7 mm. long. The complete lamp weighs 0.06 grams. It operates from a single dry cell, consumes 0.17 watt and gives only 0.028 mean spherical candlepower.

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Use of Written Sales Proposals

By A. H. WEGNER
The Washington Water Power Co.

IN THE promotion and sale of any *service* to business men generally and to busy retail merchants particularly, the use of carefully planned, well prepared, business-like sales presentations are most effective because they enable the customer to examine the proposed purchase at his convenience. Time and again instances have proved that the sale of electric service depends on carefully thought-out selling arguments that emphasize advantages of use —use that returns profit to user—and not upon rates or cost of service. One method being used by The Washington Water Power Company with considerable success as a means of getting salesmen to make planned sales presentations is a written sales proposal based on (1) written survey, (2) written recommendation.

A. H. WEGNER

What Should the Complete Written Sales Proposal Include?

It should briefly tell the story of (1) what the customer has and what it doesn't do for him and (2) what he should have and why—in terms of advantages to his business. In other words, the sales proposals should give: Survey of existing operating conditions, survey of existing equipment, summary of existing operating costs, comments and analysis, from *constructive* viewpoint, of results furnished by existing facilities, statement of suggested operating conditions, statement of recommended equipment, estimated operating cost with recommended equipment. statement of advantages of use including savings that might be effected, statement of net increased costs.

Bear in mind that no salesman expects to close a sale with every prospect, we do not expect to gain complete acceptance of every sales proposal. yet each of our men has closed *some* sales proposal. Written sales proposals are particularly advantageous in the case of stores or offices under foreign management. In such cases, the local manager can indorse the sales proposal and forward it to head office for approval. Instead of having nothing else to say other than that he "needs better lights," the sales proposal enables the local manager to tell the home office. It tells what he has; what he wants; why he should have it and its probable cost.

Sales proposals require work and careful planning before the salesman attempts to close with his prospect. They guide the salesman to be *well prepared*—to study characteristics of customers business, his needs and what electric service can do for customer's business.

Finally, however, the successful use of sales proposals depends on personal salesmanship. The sales proposal can only be a help to more profitable selling.

Solicitation of Office Lighting

By J. HOMER SHAW
Utah Power & Light Co.

EVERY important business establishment and every industry has an office, and every sizable town has office buildings. A quick tour of inspection would reveal that their present office lighting is inadequate and obsolete. We, as utility salesmen, may know that good office lighting pays handsome dividends, but we are assuming too much if we think our customers know it also. They must be told and sold.

If we are going to sell anything in quantity, whether it be office lighting, floodlighting, store lighting or fry kettles, the best way is to have a campaign—probably sixty or ninety days. We know that commercial salesmen have many other services to sell and cannot drop everything else and just sell office lighting. In most instances they can do their other work, but spend the major part of their time on office lighting during the campaign.

The campaign should be prepared and written in the general office and sent out to the division. It should also include an advertising program to help the man in the field making his first calls. Usually the advertising consists of direct mail pieces—a set of three mailings being sent out 10 days apart. Due to the fact that we do not sell fixtures, we use circulars that do not contain the name of the fixture or the manufacturer. We also include a post card that they can mail to us asking for further information. The commercial salesman should make up his own list of prospects to receive the mailings, and then follow through with a personal call.

If we are going out to do a selling job, we ought to have an objective, so quotas should be set up for each division. When the division sales manager gets the campaign and his quota, he should immediately set up individual quotas for each commercial salesman.

There should be facilities for making demonstrations. A trial installation, so the customer can see for himself what good office lighting consists of, will go a long way in closing the sale. This method of selling was found effective in a recent flood lighting campaign.

Written sales presentations, at least on all sizable jobs are effective. This accomplishes two important things. First, it aids giving the customer a complete sales talk; second, it leaves the customer a sales story that he can read over after you have left. The plan and recommendation make it easy for him to call in a contractor and ask for a bid on installing the new lighting system—in other words, easy for the customer to act.

One source of prospects is the home service department. An office man who has purchased an I.E.S. lamp for his home soon becomes dissatisfied with the lighting in his office and automatically becomes a prospect for better lighting.

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Solicitation of School Lighting

By T. W. FITCH
Portland General Electric Co.

THE MOST successful means of soliciting and selling school lighting is through personal contact with school officials, school trustees, county school officials, state superintendent of schools, and what is most important, through the Parent-Teacher's groups. In many cases these groups can be prevailed upon to make school lighting a project. Work with these groups in school buildings where the lighting is poor, and the distribution of quantities of the fine literature available dealing with school lighting and childrens' eyes, is most effective. Mailing lists should be made up of the interested parties in this connection, and material such as "Hygeia" and other medical and professional magazines to give a professional atmosphere should be sent out approximately once a month during the school term, with a concentrated drive during the last two months of each term in order to focus attention on the subject when budget time comes during the vacation period.

In suburban towns, efforts are usually more fruitful of immediate results. In these smaller communities the school district usually has but one or two buildings, and the financial problem of rewiring and new fixtures does not appear as large an obstacle as in the larger cities where a change in one old building sets the standard for changes in other existing buildings.

In larger cities a proposal to relight existing schools may be based on a step program also, taking one room in a building at a time. This is far better than attempting to compromise with a half-way lighting installation in all of the rooms. A very important first step in this connection is to have an efficient home lighting demonstration at the home of the school superintendent, members of the school board and the principal.

Adequate lighting should be a prominent part of any program of new school building construction. Architects generally have felt that they had provided a good lighting job when they had specified four or six 200-watt lamps with direct glassware for each room. Many of them now have been educated up to six 300-watt lamps per room, and a few will consent to putting in six 500-watt indirect units per room. Educational work with school officials has created a demand that has materially increased architect's specifications. Written specifications for the architect with a copy filed with the school board are an effective means.

With the installation of adequate lighting in school buildings, we feel that automatic photo-electric control is a necessity. Experience indicates that where this is not included, frequently the new lighting is operated almost continually without regard to need, and after the resulting high bills are received, the lamps are not operated when they are needed.

One company makes use of a portable photo-electric control on a 30-day demonstration where adequate lighting is installed. This demonstration unit is equipped with a separate meter and by arranging for separate metering of a similarly situated manually controlled room, some very convincing comparisons have been obtained. Architects, engineers and contractors as a whole lack essential information as to the economical installation of grouped photo-electric control. Tests have shown that an installation controlled by photo-electric cells will operate 30 per cent of the school day, while manually operated installation will operate only 16 per cent of the school day.

In Portland a survey of the schools was made about two years ago, the check showing an average foot-candle value of 5.75. This value ranged from one foot-candle in the very old schools to 11 to 15 foot-candles in the newer schools. In most cases the present capacity of the wiring was not being used, and the lights were only being burned when absolutely necessary. It is interesting to note that partially as a result of this survey and in seeing that the results were known by the proper parties, that the use of current for lighting in the schools has increased materially. New fixtures could not be purchased as the school district was in a bad way financially, but larger lamps were installed and longer burning hours were observed. Restriction on the burning of lights was lessened. The year 1937 showed over a 10 per cent gain in current used for lighting in the schools served by one company in Portland.

Industrial Power and Heating

Report of Committee*

By E. C. BRANCH
Puget Sound Power & Light Co.

THE COMMITTEE this year departed from the usual attempt to cover the whole scope of the industrial field, and confined itself to a study of the major problem involved in conducting a productive industrial heating program.

Actual experience by salesmen in the field revealed a serious lack of information on industrial heating problems as found in the Northwest. This lack of information was made all the more serious by the availability of very complete sales information on competitive fuels. The committee realized that a most worthwhile project would be the establishment of a procedure through which this information could be gathered and distributed throughout the member companies.

Every few weeks the sales organizations of member companies discover and work out new applications of electric heating particularly adapted to Northwest industry. Each time a new application is successfully made a new load building opportunity becomes available. Unless this information is available to all member companies, we are not taking advantage of the possibilities at our disposal.

This information must not only be disseminated, it must be put in the most usable form possible and to be most effective should show sales advantages, installation data and actual results and operating costs.

To fill this need the Industrial Power & Heating Committee recommended to the Commercial & Industrial Sales Bureau that a system of obtaining and distributing this information on unusual heating applications be set up.

Instead of presenting papers at the Medford meeting, the committee members presented and discussed data sheets on a total of nine unusual heating applications. These data sheets are now available for general distribution to all those interested, and are published below.

The Commercial & Industrial Sales Bureau recognized the value and need of this method of presenting factual data and passed the following resolution presented by Carl Hoffman:

> "Resolved that the Industrial Power & Heating Committee go on record as endorsing the promotion and use of uniform data sheets covering special industrial power and special heating applications, and recommend that the chairman of the Commercial & Industrial Sales Bureau petition the Advisory Executive Council of the Section for approval to set up with the secretary of this Association machinery designed to gather, prepare and disseminate such data sheets."

The committee feels that this plan will be particularly helpful and useful in maintaining a united front in industrial problems such as the growing competition with other fuels. Last but not least, it will provide a foundation for industrial power and heating sales information that will be extremely valuable in the development of new industrial business.

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Data Sheets

Electrifying a 4000-Lb. Stereotype Pot

Section—INDUSTRIAL HEATING.
Subject—ELECTRIFYING 4000-lb. STEREOTYPE POT.
Prepared by—A. B. Couch, Puget Sound Power & Light Co.
Customer—Bremerton News-Searchlight.
Nature of Business—Newspaper Publisher.
Former Method of Heating—Gas.
Resulting Operating Advantages—

1. Lower operating cost: Savings in heating cost $300 per year.
2. Improved working conditions: Waste heat and fumes from gas pot eliminated.
3. Lower maintenance cost: Eliminates pot cracking.
4. Accurate temperature control: Positive control with reduced temperature over-run provides uniform casting.
5. Saves metal: Closely regulated temperature prevents excessive tin losses due to evaporation.
6. Faster recuperation: The electric operation speeded up melting time.

Operating Results—
2500 lb. to 3500 lb. metal/day, 6 days per week.
Former Av. gas cons.—65 MCF/mo.
Cost of gas—85c per MCF.....$55.00
Kw.-hr. for same output—3000/mo. Cost @ 1c/kw.-hr. 30.00
Net Saving per Month.....$25.00

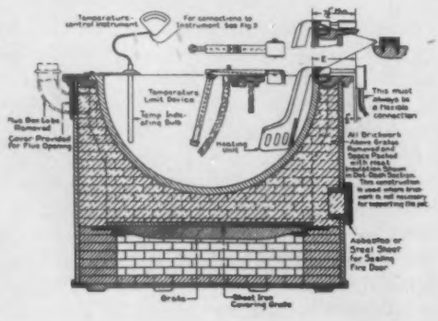
Method of Heating Electrically—Due to the fact that pot is used to refine and recast linotype pigs in addition to supplying stereotype metal for 16-page Goss rotary press, it was necessary to hood pot to carry off refining fumes. A damper was installed in the flue to control draft. Three inches of Wyo-lite plastic insulation was applied to the outer casing of pot and hood.

The electrical installation consists of four 5-kw. G-E immersion units controlled by thermostat and contractors.

Operating Results and Costs—Operation consists of turning on the pot at 6:30 a.m. and turning it off when the day's work is completed at about 3:30 p.m. It requires 2 hours to reheat the metal to the proper casting temperature of 650 deg. F. each morning.

The operating costs shown were carefully checked over a six-months period. The gas consumption was averaged over a four-months period prior to the conversion to electric.

Results demonstrated that the pot could be economically operated with the ventilating hood which allowed for refining sweepings and linotype slugs in addition to supplying stereotype metal. This is possible with electric operation since the pot can be completely shut off at night and reheated the following morning without danger of cracking. This means a saving in equipment inasmuch as a separate refining pot was not required.


Temperature control instrument
For connections to instrument see Fig 3
Temperature Limit Device
Temp Indicating Bulb
Heating Unit
This must always be a Flexible connection
Asbestos or Sheet Steel for Sealing Fire Door
Grate
Sheet Iron Covering Grate

Electric Heating for Baking Sugar Wafers

Section—INDUSTRIAL POWER & HEATING.
Subject—SUGAR WAFER MACHINE.
Prepared by—D. H. Hutchinson, Utah Power & Light Co.
Customer—Purity Biscuit Company, Salt Lake City, Utah.
Nature of Application—Baking of sugar wafer shells.
Former Method of Heating—Gas.
Method of Heating Electrically—Inasmuch as no suitable equipment was available in 1926, units were made on special order using cast-in Calrod units in cast iron plates. Each plate is approximately 8 in. x 10 in. with a 750-watt, 220-volt element. Four plates are used for each of the seven machines, two plates on the top baking surface and two on the bottom bolted to the backs of the baking surfaces between which the dough is baked. These machines have the general appearance of a large waffle iron with changeable baking surfaces for various designs of wafer. The top pair of plates and the bottom pair of plates are each controlled by a 3-heat switch.

Operating Results and Costs—The cost of the gas used in these machines is not available. However, gas is used for other large ovens and is bought in large quantities so that the cost of gas chargeable to the machines in question is very small. Thus the job was sold entirely on the superior service rendered by electric equipment.

The advantages of electric service over gas in this installation are: (1) Even heat distribution resulting in better product, less spoilage and increased production; (2) better working conditions.

During the past 12 months the seven 3-kw. machines used 20,025 kw.-hr. costing $541.68. As yet no units have failed and they have been in operation eleven years.

50-kw. Electric Steam Boiler Cures Tires

Section—INDUSTRIAL HEATING.
Subject—LARGE CAPACITY ELECTRIC STEAM BOILER FOR TIRE CURING.
Prepared by—T. N. Hunt.
Company—The Washington Water Power Co.
Nature of Business—Tire shop.
Former Method of Heating—Oil fired boiler.
Method of Heating Electrically—50-kw. fully automatic electric steam boiler.
Operating Results and Costs—The electrical power cost per tire for curing with the above steam boiler is as follows:

Date	Kw.-hr. Boiler	Cost Power	No. Small Tires	Cost per Tire	No. Truck Tires	Cost per Tire
Aug. 4-31,	4,790	$59.04	200	15c	63	46c
Aug. 31-Oct. 1...	5,693	69.66	253	16c	54	54c

No information is available regarding the fuel cost per tire for the oil fired boiler; however, the customer is well satisfied with the operating costs of the electric boiler. The boiler is designed to operate at between 45 and 55 lb. pressure and, with temperature and water controls, it is fully automatic requiring no attention. The time required to cure a small tire varies from 55 to 90 minutes, while truck tires require from one hour and 45 minutes to two hours and 15 minutes.

* E. C. Branch, Puget Sound Power & Light Co., Chairman; B. C. Electric Railway Co., H. O. Bulmer; The California Oregon Power Co., H. E. Goidson; Eastern Oregon Light & Power Co., J. K. Moore; General Electric Co., C. E. Canada; Idaho Power Co., Robert Hogg; Northwestern Electric Co., R. W. Faville; Pacific Power & Light Co., B. P. Baily; Portland General Electric Co., A. H. Greisser; Utah Power & Light Co., D. H. Hutchinson; The Washington Water Power Co., T. N. Hunt; Westinghouse Electric & Manufacturing Co., Stan Harrison.

Motor Cleaning with Air and Hot Water

Section—INDUSTRIAL POWER & HEATING.
Subject—AUTOMOBILE MOTOR CLEANING.
Prepared by—T. N. Hunt.
Company—The Washington Water Power Co.
Nature of Application—"Steam cleaning" system using hot water and compressed air.
Former Method of Heating—New installation.
Method of Heating Electrically—Hot water of about 180 deg. Fahrenheit is mixed with air at about 100 lb. pressure in a DeVilbis Air Water Gun and the resultant mixture of hot water and air used as a "steam cleaning" system. Hot water is supplied from a standard off-peak electric water heating service and the air from any compressed air system capable of maintaining the pressure. The air-water gun comes equipped with a short nozzle. However, it has been found that by extending the nozzle 12 to 15 inches, the gun is more convenient to handle. To make the extension, an outside pipe (standard ⅜-in.) and inside pipe (standard ⅛-in.) are inserted in the end of the nozzle.
Operating Results and Costs—This method of using hot water and air for "steam cleaning" should not be compared with specially built cleaning equipment using live steam. However, it does have application in the small garage or machine shop where the volume of cleaning work does not justify expensive equipment. The cost of cleaning will vary with the quantity and kind of grease that has to be removed, so that it is difficult to estimate the actual cost per motor. Records of twelve installations show an average monthly consumption of 370 kw-hr. on our standard off-peak electric water heating service. However, this monthly consumption includes power used for heating water used for car washing and other purposes as well as "steam cleaning."

Electric Heat for Radiator Cleaning

Section—INDUSTRIAL HEATING.
Subject—ELECTRIC HEATING OF AUTOMOBILE RADIATOR CLEANING BATH.
Prepared by—B. P. Baily, Pacific Power & Light Co.
Customer—Traub Bros., Yakima, Wash.
Nature of Business—Automobile Shop.
Former Method of Heating—Gas.
Method of Heating Electrically—A 1-hr. immersion unit was installed in an insulated tank made of ¼-in. steel, size 3 ft. x 3 ft. x 4 ft. Tank is filled approximately 1/3 full with a patented solution known as "Oakite." A special sheath was used on this unit, as the sheathed heater will not stand up in this acid. Heater is thermostatically controlled.
Operating Results and Costs—Liquid in this tank is maintained at a temperature of 190 to 200 deg. and the method of operation is to place auto radiators in the solution and let them soak for a period of 1½ to 2 hours. They are then removed and all scale and other deposits can be easily flushed out. The average monthly consumption is 537 kw.-hr. As the average bill is $6.25 a month, the average kw.-hr. rate is 1.16c. Customer states that the former method of heating cost him from $25.00 to $30.00 per month.

110-kw. Installation for Pipe Painting Plant

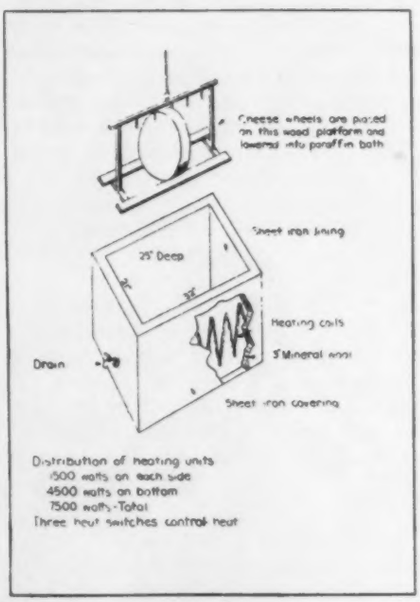
Section—INDUSTRIAL HEATING.
Subject—ELECTRIC HEATING FOR PAINT DRYING & SPRAYING.
Prepared by—H. Van Wyke, Puget Sound Power & Light Co.
Customer—Puget Sound Machinery Depot Co. and Western Pipe and Tank Co.
Nature of Business—Joint contract to furnish water pipe for City of Everett. (Special job.)
Former Method of Heating—This was the initial installation made in competition with steam and gas heat.
Method of Heating Electrically—
Problem No. 1—The Puget Sound Machinery Depot constructed three uninsulated frame buildings of the following sizes to paint steel water pipes for the City of Everett's water supply system:
Building No. 1—42 ft. x 155 ft., height 12.5 ft. to 9.5 ft.—sloped roof.
Building No. 2—40 ft. x 102 ft., height 12.5 ft. to 9.5 ft.—sloped roof.
Building No. 3—40 ft. x 122 ft., height 12.5 ft. to 9.5 ft.—sloped roof.
Each building accommodated 25 pipes 40 ft. x 55 in. in diameter, weighing 3½ tons each.
It was necessary to maintain 70 deg. temperature inside of the three buildings during the day and 60 deg. during the night. The job extended from April to November.
Solution—7—5-kw. unit heaters were installed near the ceiling in each building. These heaters were made up locally and consisted of 10 in. 600 FPM Peerless fans mounted behind Chromalox finstrips. Each unit heater was protected by a thermocouple and controlled by a thermostat and contactor. The fans were controlled manually and ran continuously to take advantage of air circulation.
The calculations were based on April weather averages of 62 deg. F. max. and 45 deg F. min.
Problem No. 2—Difficulties were experienced with the paint spraying machine due to heavy consistency of the asphalt paint. Two 150-gal. paint storage tanks and two 10-gal. pressure tanks on the painting machines required heat to maintain the paint at 100 deg. F. The nozzle of the paint machine was fed through 40 inches of pipe to allow the machine to paint the entire interior of the pipe from one end. It was also necessary to supply heat to this pipe.
Solution—The two 150-gal. tanks were water jacketed and two 7½-kw. insert heaters installed in the water bath on each tank. The 10-gal. pressure tank was likewise jacketed and a 3-kw. insert heater installed. The temperature of each tank was controlled thermostatically. The 40-in. nozzle pipes were each wrapped with one kw. of soil heating wire and covered with three-ply pipe covering.
Operating Results and Costs—Production was maintained with only buildings No. 1 and No. 2 heated.

Total Space Heating Used..... 70 kw.
Total Paint Heating..... 40 kw.
110 kw.—Total

Reading Date	Kw.-hr. Con.	Max. Av. Monthly Temp.	Min. Av. Monthly Temp.	Mean Monthly Temp.
6-25-37	10,720	71.4	54.3	63.0
7-26-37	7,390	75.3	56.3	65.8
8-25-37	7,230	72.8	56.0	64.4
9-24-37	7,800	68.5	53.5	61.0
10-25-37	22,230	63.7	49.7	56.7
11-24-37	*3,200	53.4	44.3	48.8

* The operation was completed in the second week of November and very little consumption is shown as a result thereof. Part of the job was started in May, 1937. The higher reading on 6-25-37 is caused by colder weather. Also, calculations for installed kw. were made to take care of the two extremes in May and November.

The installation was satisfactory from all standpoints. After installation it was decided to maintain 80 deg. F instead of 70 deg. F. during the day and the heaters easily met the additional requirements. The unit heater installation provided extreme flexibility; the temperatures in any part of the buildings could be controlled separately to increase or decrease drying speed.
Since the job was of a temporary nature, high salvage of the heating equipment was important. The electric equipment had a much higher salvage ratio than the other proposed heating methods.


Cheese wheels are placed on this wood platform and lowered into paraffin bath
Sheet iron lining
25' Deep
Heating coils
Drain
Sheet iron covering
Distribution of heating units
1500 watts on each side
4500 watts on bottom
7500 watts-Total
Three heat switches control heat

Paraffin Vat Heated for Coating Cheese

Section—INDUSTRIAL POWER & HEATING.
Subject—ELECTRICALLY HEATED VAT.
Prepared by—T. N. Hunt.
Company—The Washington Water Power Co.
Nature of Application—Paraffin vat for coating cheese wheels.
Former Method—New installation.
Method of Heating—See accompanying sketch.
Operating Results and Costs—Cheese "wheels" are received in what are called the "fresh" or "raw" state and then coated by dipping in hot paraffin. This coating of paraffin prevents the formation of mold so that the cheese wheels may be kept for long periods of time without danger of spoiling. No figures of operating costs are available. The total heating capacity is used only for about 45 minutes to bring the paraffin up to the proper temperature, which is then maintained by part of the connected load. The use of electricity for heating this tank eliminates all fire hazards, fumes, dirt and gives perfect temperature control.

Electric Water Heating for Mine Bunk House

Section—INDUSTRIAL POWER & HEATING.
Subject—WATER HEATING.
Prepared by—D. H. Hutchinson, Utah Power & Light Co.
Customer—Silver King Coalition Mines, Park City, Utah.
Nature of Application—Water heating for boarding house, bunk house, office use, and shift bosses change room.
Former Method of Heating—Steam from coal fired boiler.
Method of Heating Electrically—Two 40-gal. and two 140-gal. automatic electric water heaters located near the individual points of use which were respectively; the office, the change room, the kitchen, and the bunk house.
Operating Results and Costs—The results are superior hot water service with a saving of about $6.00 a day in the summer and $2.00 a day in the winter on coal alone. Additional savings to the mine are effected by transferring two fairly high priced boiler men to other work and replacing them with one lower priced man to fire for such steam as is still required. The estimated average net saving is $10.00 a day. The additional kw.-hr. are are estimated at 4,000 a month, and the estimated annual revenue, $350.00.

Central Station Power vs. Isolated Plant

Section—INDUSTRIAL POWER & HEATING.
Subject—CENTRAL STATION POWER vs. ISOLATED PLANTS.
Prepared by—Industrial Power & Heating Committee, E. C. Branch, chairman.

Problems Plant Owners Must Face if Own Power Is Generated

I. Plant Owner Limits Future Expansion of His Plant.
(a) With rapid development in new and high speed production equipment requiring more power, the plant owner is unable, many times, to take advantage of technological development in his industry. He not only is faced with a shortage of power, but has invested money in an outgrown power plant which should be available for modernizing production equipment. If plant owner installs equipment to meet future plans, his initial installation is usually heavier than present requirements demand, with the result that he is unnecessarily carrying a heavier investment and running in an inefficient manner, thereby increasing the fixed charges on the cost of his finished product. Power furnished by central station is always available in any quantity required by plant owner's development, and he is therefore able to eliminate higher initial and operating costs. On the other hand, if there is a decrease in amount of power required due to changed economic conditions, plant owner's equipment may prove too large and its efficiency uneconomical.
II. Plant Owner Assumes Extra Hazards
(a) He gambles that electric rates will not decrease and wipe out the value of the power plant investment. The tendency of electric rates over the past few years is downward. Plant owner loses this advantage through purchase of individual plant, for whether purchased for cash or on the installment plan, his rate is more or less fixed or constant. If purchased on a "power saving" plan, his payments are based on a fixed electric rate and he loses any prospective benefit from further reductions in power company rates. If his annual consumption decreases, he would suffer an increase in the unit cost of energy.
(b) He gambles that his generating equipment will not break down causing heavy production losses during rush periods. Power company is vitally interested in the successful operation of the plants it serves, and not only employs expert labor which is ready at a moment's notice to rush to a customer's relief, but either carries on hand or is cognizant of the whereabouts of extra or auxiliary equipment. Power company's interest in this respect is quite different from that of the firm selling individual power plants

whose principal interest is to see that their bills are paid promptly.

(c) He assumes a minimum power cost that is less flexible than purchased power minimum charges. The minimum charge obligations he assumes in purchasing power are considerably less than the fixed obligations which accrue through the purchase of his own power plant, and the term over which they apply is, as a rule, much shorter.

(d) He gambles that fuel costs will not increase, and their supply will not be cut off.

III. Operating Problems.

(a) Plant owner is forced to devote executive time to power plant problems which could be more profitably devoted to production problems in his own business. The utility company makes power production its sole business and the plant owner will profit by letting the utility assume the risks. The purchase of power saves time to plant supervising personnel, which can devote itself to the principal business of the industry with which it is better acquainted, while an individual power installation requires giving time and attention to a matter which is beyond its knowledge and experience. Plant owner would have considerable hesitation about employing inexperienced help to operate a department of his own business as important to his entire operation as the maintaining of a constant and reliable source of power.,

(b) Rush orders that demand overtime work of a department cannot be handled without depending on operation of other departments. With central station power, any one department of a plant owner's business can be operated without using his main power plant, or portions of a plant can be shut down for repairs or rehabilitation without closing down the entire operation.

IV. Plant Owner Is Faced with the Additional Problems Of:

(a) Uncertain voltage and frequency conditions affecting speed of production machinery. Various types of load on a central system require almost constant voltage and frequency conditions. To furnish this type of service requires expensive and elaborate regulating equipment which would be uneconomical to install in a small plant, but due to its being common to the entire system of a central station, the small plant owner receives this advantage without extra cost to him.

(b) Providing stand-by service and allowing for maintenance shut-downs. A central station necessarily has to provide standby service, which would also be true of an individual plant, to insure similar continuity of service. Thus the customer is saved this added investment which gives him more money to put back into his own business.

(c) Employing competent help to safeguard his investment in expensive machinery. In order not only to protect his investment but to guard against heavy maintenance expense, an individual plant owner necessarily has to hire competent help which is not necessary with central station service. The unions are already insisting that, in the case of an oil engine installation, an operating engineer shall be on shift at all times and that his pay shall be considerably higher than that of individuals carrying on other operations in the plant.

(d) Providing space for generating and boiler equipment. The installation of a private power plant reduces the floor space of the plant owner in every instance. In most cases, the space thus used would be more valuable for the owners if it was devoted to extending his factory or for a better spacing of his other equipment. The value of the land occupied should be taken into consideration, as it undoubtedly forms part of his cost.

V. Can Investment Be Justified Even if Savings Are Apparent?

(a) Study net earnings of proposed power plant with prospect to be sure all cost factors are taken into consideration.

(b) Determine net earnings of proposed plant.

(c) Show prospect that investment in power plant would provide less return than similar investment in his own business and in addition he would be assuming risks outlined under Paragraph II. See capital advantages, 9 to 14, in below summary.

Plant owner's capital will be much more productive if he uses it in modernizing his factory and in obtaining economies by improving his manufacturing methods than by investing it in a power plant. Even if a reduction is obtained in the cost of power by installing a separate plant, such reduction will be very small when compared with what the profits might have been if this same capital had been invested in the plant owner's principal industry.

Advantages Customers of Central Stations Enjoy

Basic Advantages

Our service is convenient, reliable, flexible, safe, economical, quiet, clean, and we furnish engineering service.

Capital Advantages

Our service reduces the capital required; releases capital for investment in extension of, or modernization of production facilities; eliminates loss of interest on money tied up in power plant; conserves valuable space; eliminates the necessity for amortization of investment in power plant facilities; and makes expansion possible with a minimum added investment.

Operating Advantages

Our service eliminates the responsibility of power production; makes full, accurate power costs readily obtainable; simplifies accounting; assures freedom from liability; minimizes the fire hazard; eliminates insurance on power plant; often reduces the insurance rates on the entire property; reduces or solves fuel and labor problems; is more healthful for employees; eliminates complicated belting and shafting; permits variable speeds wherever needed; and makes available the flexibility of remote controls.

Production Advantages

Our service release supervisory time for industrial problems; insures a better quality product, increases production; and lowers overhead and total costs per unit produced.

Rural Sales Bureau*

Rural Sales

By W. R. NEWMYER
Portland General Electric Co.

THE Rural Sales Bureau is made up of power company employees, representatives of dealers and manufacturers and of the agricultural engineering departments of the state colleges and universities. The work of the members falls into two main classifications, namely, line extensions and load building. Of course we also do some trouble shooting (mostly nights and Sundays), go out on high bill complaints, work with the public relations departments of our companies, and do other odd jobs.

When asked how many rural customers they were serving, how many they had added during 1937, and how many rural homes were yet unserved, some of the member companies were unable to answer exactly, but by using the figures that were available we can safely say that over 5,000 new rural customers were connected in the five Northwestern states and British Columbia during 1937.

About 75 per cent of the total available customers are served in those territories having the lowest saturation. That percentage runs up to approximately 94 in those territories having the highest saturation of electrified rural customers. These 5,000 new customers will use, at a very conservative estimate, three million kw.-hr. annually and will pay in revenue about $110,000 annually.

Now for the second part of our work, that of load building. We create wealth. Our load building activities on the farm increase the farmer's net income. The average gross farm income in western Oregon is $1,000 a year. That is the gross income, not the net profit. Can you sell many ranges, refrigerators or water heaters to that income group? Of course not. We try to help the farmer increase his earnings so that he can buy such things.

For example, during the past eight years through the cooperative effort of the members of the bureau, about 20,000 acres of western Oregon farm lands have been put under irrigation. At a very conservative estimate, the net (note the word "net") income per acre has been increased more than $40 per year. Forty times 20,000 equals $800,000. That is extra money these farmers have to spend each year. We will get our share of that besides the revenue derived from selling the power to drive most of the pumps.

Another example: There are about seven million laying hens in this Northwest territory. By hatching and brooding many of these birds the electric way and by supplying lights for the laying houses and warming water for the hens, we have increased the net profit per hen by at least 10 cents annually. That is another gain of $700,000 in the farmer's net income—increased wealth. We do not hatch and brood all of these birds electrically, but in the past few years we have placed enough machines on the farms to raise the net income of all the layers by the amount stated.

Those are just two of the many ways the members of the Rural Sales Bureau help the farmer help himself and, incidentally, add to the companies' revenues.

Bureau Cooperation

Cooperation among members of the Rural Sales Bureau is 100 per cent. Let me cite a case. Due to the fact that there are only 24,000,000 pounds of poultry in storage now as against 37,000,000 pounds at the same time last year, the poultrymen see a chance for profit in raising broilers.

Upon being called out by one of

* Rural Sales Bureau: W. R. Newmyer, Portland General Electric Co., Chairman; Earl A. Olson, Idaho Power Co., Vice Chairman; B. C. Electric Railway Co., S. J. Bowman; Eastern Oregon Light & Power Co., R. L. Saling; Graybar Electric Co., S. G. Ward; University of Idaho, Hobart Beresford; Montana State College, H. E. Murdock; Mountain States Power Co., C. B. Greenough; Northwestern Electric Co., C. A. Root; Oregon State College, F. E. Price; Pacific Power & Light Co., C. O. Bunnell; Portland General Electric Co., Ben Faber, L. C. Moore; Puget Sound Power & Light Co., W. A. Luce, J. C. Scott; Utah Power & Light Co., W. A. Huckins; Washington State College, Harry Garver; The Washington Water Power Co., J. F. Farquhar; West Coast Power Co., C. A. Comstock; Westinghouse Electric & Manufacturing Co., C. E. Klaus, J. G. Miles.

these men not long ago, I found he wanted to air condition two rooms each 32 ft. x 48 ft. with a 7½ ft. ceiling. He wanted to maintain a room temperature of 70 deg. and that is all he knew, except that he wanted to kill a thousand birds a week, and to do that he would need about 12,000 birds ranging in age from day-old chicks to maturity. He didn't know how many air changes per hour he would need or anything about the equipment necessary. I didn't either, but through the close cooperation which the members of the bureau enjoy, I knew where I could get the information for him.

When I asked him how soon he wanted these data, he said, "I don't want data; I want the equipment right now as I have about 4,000 chicks started and they are dying for lack of proper atmospheric conditions." He was soon given the necessary information. The equipment is now in and operating satisfactorily.

Emergency calls such as that are not uncommon. Through our wonderful cooperation within the bureau, such things are easily handled.

Handbook

In 1933 the Rural Sales Bureau had printed a technical handbook covering electrical farm equipment which had proven practical on the farms. This book was strictly a handbook and contained very little sales manual material. Dut to the rapid development of new equipment and changes in the old, parts of this handbook are now obsolete and also new sections are needed.

We of the bureau decided to revise the handbook this year. For that reason a meeting was held in Puyallup, Wash., last fall, which was attended by 26 of the bureau members. We went through the handbook section by section and decided what parts needed changing, and what new equipment should be covered in the new book. We also assigned various parts of this work to the bureau members knowing most about each particular subject. This material is now practically all written and will soon be ready for the printer. We expect to go to the Association Executive Committee for authority and an appropriation to publish the new handbook. Your moral support of this project is solicited.

Summary of Meeting

Some of the high lights of the discussions at our bureau conference are summarized as follows, from notes by C. A. Root, Northwestern Electric Co.

Art King, Oregon State College, discussed the outlook for irrigation in Oregon. An abstract of his remarks follows:

In eight years about 20,000 acres have been put under irrigation in the Willamette Valley. In the valley and surrounding territory there is a possibility of placing a total of 1,000,000 acres under irrigation. This would support as much as 10,000 additional farm families, or to be very conservative, 3,000 farms which would be about the same as adding another county the size of Linn County. This irrigation, if and when ultimately brought about, should produce an annual gross income increase of some $800,000.

Chief benefit of irrigation is that it produces additional income for the farmer which enables him to buy the semi-luxuries and maintain a good standard of living.

Oregon, with 500 acres of green beans, produced 16 per cent of all the canned bean supply in the U. S.

New developments are looked for in the frozen vegetable field. This will require the highest grade vegetables, which can be produced satisfactorily and in large quantities only under irrigation. The Ray-Maling Co. is putting up a new frozen foods factory at Woodburn.

Irrigation costs can be lowered by irrigating more land with existing equipment. Seed crops are a good possibility under irrigation. Irrigation is a primary job and farm work is scheduled around this idea. Irrigation should not be considered just as an extra to fill in odd moments.

Water may be pumped from irrigation ditches for sprinkler irrigation on land too steep for gravity irrigation with the same water. It is more expensive, however, under conditions favorable to gravity irrigation. Things to consider in making choice are: (a) cost of original installation, (b) labor cost, (c) quantity of water available, (d) power costs, (e) lay of land, and (f) type of soil.

A $30 to $40 land leveling cost should not discourage gravity irrigation if other factors are favorable.

Whereas New Jersey boasts one to two tons of green beans per acre if heavily fertilized, the average Eugene yield of irrigated land is about 9½ tons. Strawberries and some other crops should be irrigated after the crop is harvested to prepare for next year's crop.

He explained the testing of soil to determine moisture content. Also explained that soil does not make all its moisture available to plants. There is considerable variation in this effect depending on type of soil. The State College will make up a soil-moisture percentage table.

R. W. Hutchinson, Westinghouse Electric & Manufacturing Co., led discussion on the "Farm Utility Motor."

He believes capacitor motors will eventually replace repulsion-induction motors in the fractional horsepower field. He warned against being misled into overloading repulsion-induction motors because of the fact that they will start a load of from 600 per cent to 700 per cent full load.

There was a discussion of forced ventilation electric brooders and brooding led by C. A. Root, Northwestern Electric Co.

Members of the Rural Sales Bureau viewed sprinkler equipment displayed in park block by R. M. Wade Co.

J. R. Henshaw, Pure Iron Culvert Co., demonstrated a new coupler for irrigation lines.

C. B. Greenough, Mountain States Power Co., read paper on irrigation in Tillamook County. (See extracts printed)

F. E. Price, Oregon State College, described irrigation project at O.S.C. where water is pumped from a stream rather than to build a dam. Reason, pump cost was less than a dam. Dam would not be permanent because of high water and floods. Labor costs were lowered since they are now watering 50 acres with less labor than 35 previously.

R. Overstreet and W. T. Summers, Idaho Power Co., described drainage wells used in irrigated territory.

F. E. Price, led discussion on air movement, artificial drying and ventilation. He reported O.S.C. is doing considerable work on the artificial drying of corn. He considers this important as Oregon is importing some 1,000 carloads a year, with a value of approximately $300,000. Corn may be dried in 60 min. artificially as compared with 12 hours under favorable outside conditions. Oregon with its high humidity and relatively high temperature makes storing of corn difficult because of danger of mold.

He stated air flow equipment should be figured as accurately as possible, the same as a water pumping job would be figured. Propeller type fans, in cases where static pressures are low (less than .2) and large volumes of air are to be moved, are often more economical than multivane.

He discussed poultry-house, battery laying house, and battery brooder house ventilation. He said that natural ventilation where dependent on a heating plant in brooding houses was just backwards from what it should be. Since the heat is decreased as the chickens grow older, the ventilation is also decreased, but the demand for fresh air has increased.

He reported on the artificial drying of hay. Jobs should be on a commercial basis generally. They should be capable of caring for 1,000 tons a sea-

son. Such a plant will cost about $5,000 to $6,000. Cost of drying will be $8 to $9 per ton on this basis including overhead and operating costs. He recommended hay be wilted in the windrow before drying. Portable plants generally are impractical.

He reported on fatal electric fence accident at Toppenish, Wash., and there was discussion of electric fences.

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Promotion of Farm Lighting

By WALTER E. POTTER
Incandescent Lamp Dept., General Electric Co.

THE FIRST formative months after electric service has been brought to the farm and rural home are vitally important. During this period farm families form a conception of the value of electricity which determines for years to come whether or not they will enjoy the profit, convenience and freedom from drudgery that full use of electricity can provide. Truly it is a time when they need a sound understanding and a sincere guidance with respect to electrical applications on the farm.

In the beginning the rural service representative accumulated and presented preliminary data pertaining to electricity on the farm, stressing the simple advantage of electric lamps in place of other sources. Other than providing a single electrical outlet in each of the main rooms of the house with a few additional outlets in the various farm buildings little was done to stimulate and promote the greater use of electricity.

After these early efforts, the next step was the development of electric equipment and appliances for farm use. In slow but sound progression, there came into existence an extensive line of electric equipment designed to help the farmer and his family utilize electricity more profitably, conveniently and enjoyably. However, in the farm home itself little effort has been expended to increase the use of electricity. True, we have promoted radios, washing machines, electric irons and some electric ranges.

Enjoyment of as many of the benefits of electricity as he can afford is the natural wish of every farmer who receives electric service. Increasing the use of electricity on the farm in order that rural extensions may become more profitable is likewise the natural aim of each utility.

Few farmers, however, are in a position to electrify their farms completely at one time. They, like people in the city, must usually proceed step by step toward an ultimate goal. If through lack of proper information a farmer should invest a large amount of his capital in an electrical device which does not give him real and lasting benefits, that device will be little used and the farmer's investment in other electrical equipment will be long delayed. Neither he nor the utility gains the results desired.

If, on the other hand, the farmer and the utility together plan a step-by-step electrification program based on the individual needs of that farmer with services selected in the order of their importance to him, both the farmer and the utility will profit continually from their association. Each step taken should and will, if properly planned, lead to and pay for the next step.

We believe it is the function of the manufacturer to make clear the benefits which his products will give to the farmer and the utility and thus assist the utilities and the farmers alike in jointly planning economical, sound and profitable programs for each individual case.

The lighting section is a vital part of a continuous comprehensive and coordinated program in the interest of making a rapid electrification of rural America more beneficial to all.

To assist your central station, the General Electric Co. offer several mediums of promotion including a talking picture film entitled "Bill Howard, R.F.D." There are available 5 sound slide films which can be used for grange meetings, etc. entitled: Light on the Farm, Farm Wiring, Farm Motors and Electricity and Plant Growth.

Generally the farm family does not fully understand as yet about lighting:

1. The extent to which good light can protect eyes, lighten tasks and beautify the farm home.

2. The degree to which light can benefit the farmer in his business of farming just as it benefits city men in their business.

Today the rural specialist must be able to advise the farmer:

1. What kind of fixtures and lamps they need and where to place them to obtain the quality of lighting they want.

2. What size lamp bulbs they need to obtain the amount of lighting they want.

3. When to buy the things they need and how much they cost.

Lighting equipment including fixtures and I. E. S. lamps are now available in a wide range of prices. Many manufacturers have in stock with dealers innumerable designs very moderately priced. Approved I. E. S. floor lamps with correct size Mazda bulbs may be obtained for as low as $7.00 retail, with I. E. S. junior floor lamps which can be purchased from $5.00 up. Many new adapter units for drop cord and ceiling fixtures can be secured for $1.50 etc. The new silver bowl lamp has opened up this market with new styles. One utility alone disposed of over 2500 last year to rural customers.

Each utility should make use of the home lighting advisors to the fullest extent in rural areas. These girls are thoroughly trained in lighting and have assisted materially in adding load along with building a greater appreciation of electric service.

It has been proven over and over again that:

1. When a farm family has been shown the benefits of good lighting and shown how to obtain it, that family is quick to take action and eager to express its thanks for the service rendered by the utility.

2. Good lighting which yields the farmer so many initial benefits can be provided with so small an investment that it is within immediate reach of all electrified farms.

3. The utility which helps a farmer obtain good lighting, first achieves an immediate profitable load in the higher rate brackets and has not caused the farmer to make any large capital expenditure.

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96 in. of Rain Plus Irrigation

By C. G. GREENOUGH
Mountain States Power Co.

TILLAMOOK COUNTY located in western Oregon along the Pacific Coast has made a name for that area in the manufacture of cheese. Many factors enter into the production of this product. Large investments are involved such as good land, high producing cows, proper types of buildings, machinery, and various equipment, but with all these conditions favorable, good management is the factor that governs their success.

There is possibly no area in the United States that has the amount of rainfall that Tillamook County averages, and receives the amount of return from irrigation. That is rather a broad statement, but we feel it to be a "believe it or not." Ninety-six inches of rain in a year is a large amount of water and would, if control were possible, eliminate supplementary irrigation. Since this control is not possible, irrigation has a very important place in profitable farming there.

The Tillamook dairymen are constantly striving to lower their production costs and although it is a natural

grass country having more pasture days per season than many other sections, substitutes must be added during a portion of the summer months, as there is less than 3 in. of rainfall in June, July and August. These prepared feeds and succulent crops such as stock beets naturally increase production costs. With the hope of reducing the cost of producing milk, the Oregon State College Extension Service and the Mountain States Power Co. entered into an irrigation demonstration with an interested dairyman. A 5-hp. sprinkler system of the type recommended by Oregon State College was installed during the late summer of 1933. Fifteen acres of Ladino clover were irrigated and proved of definite economic value for the section, as it gave an increase of over $400 on Ladino clover pasture as the entire source of feed. This first irrigation system created considerable interest and the question arose in regard to irrigation of native pasture grasses. This type of pasture was irrigated as well as Ladino clover and has proven very successful.

In the Tillamook area, starting with one sprinkler irrigation system in 1933, there have been installed 30 systems by 1937 on 550 acres of native grasses and Ladino clover pastures. About 60 per cent of these systems are electrified and the balance are gravity and gasoline engines. That is an outstanding record for an area having 96 in. of annual rainfall.

Possibly the most convincing proof we could have is taken from Chris Wyss' irrigation operations for 1936-37. This information was made possible by the accurate records kept by Mr. Wyss with the cooperation of W. L. Olsen of the Mountain States Power Co. The report shows an investment of $1050 for irrigation equipment, including pipe, sprinkler heads, switches, pump, motor, wiring, and private power line. He uses a 5-hp. motor and pumps 120 g.p.m. against a total head of 100 ft. Mr. Wyss irrigates a total of 32 acres, 22 acres permanent native pasture and 10 acres of grass and clover hay sufficient for his needs. In 1936-37 he pastured 33 head of dairy cows on irrigated pasture compared to 28 head before irrigation in 1934-35. In 1936-37 he produced 21,258 pounds of butterfat with 33 cows and in 1934-35, 16,370 pounds with 28 cows. This gave a gross increase of 4,888 pounds at 48c per pound (the average price for 1936-37) or $2,346.24, which represented his increased gross earnings, with an irrigation equipment investment of $1050. The operating cost for electricity totaled $109.42 covering the four months' period in 1936 and $92.00 for three months used in 1937. These operating costs for electricity show $3.40 per acre per season in 1936 and $2.90 in 1937.

One factor of considerable importance is fertilizing. Mr. Wyss has a liquid manure pit and utilizes all liquid manure produced. Irrigation aids in deriving the most value from any fertilizer.

Finally, savings of approximately 10c to 12c per pound of butterfat are made with irrigated pasture over other feeding methods from the standpoint of crops grown and labor involved.

Advertising Committee*

Better Advertising

By M. L. CUMMINGS
Utah Power & Light Co.

IT HAS BEEN said that you are making real progress when you are seeking a better way of doing a job after a good way has already been found. And so, if I were asked to write a headline covering the meeting of our advertising committee, it would be something like this: "ADVERTISING COMMITTEE DISCUSSES WAYS AND MEANS OF DOING THE JOB BETTER."

Amplified, this means that practically all of the subjects covered, and the resultant discussion in our meetings were tied in with present day problems in the advertising field. Past experiences and results were brought into the picture, of course, but growing out of these, fortified by new ideas, was a fund of valuable material with which to build our advertising plans to meet today's requirements.

It would undoubtedly be an overstatement to assert that we actually settled many problems. Such results are seldom, if ever, achieved in the advertising game. The fundamentals remain fairly standard, but the creation and application of ideas and methods presents an everchanging panorama.

It is wholesome and beneficial, however, to have such group of advertising men sit around a table, exchange ideas, and incidentally do some checking up on each other's methods with the definite objective of developing constructive suggestions for business building in our industry. I am sure that every individual who attended our meetings secured a great amount of value therefrom, which should be reflected in future accomplishments.

Inasmuch as the time and space are limited, this report presents only a brief summary of an exceptionally interesting meeting.

Summary of Meeting

The first speaker was Glenn L. Jackson, California-Oregon Power Co. "Advertising is an investment, which must definitely show a return on the money invested," said Mr. Jackson, in pointing out that his company does not look upon advertising as a necessary evil or as a donation to newspaper publishers in an effort to obtain their good will and cooperation.

He stated that in 1924, faster development of the use of electricity by customers on the Copco lines was most imperative, as a result of rate reductions. Accordingly, an aggressive selective advertising and sales campaign was planned to sell electrical appliances.

"First," said Mr. Jackson, "a comprehensive analysis was made as to the income, standards of living and credit rating of every individual customer on our lines. The good prospects were placed in one group and an intensive barrage of direct by mail advertising directed at these people—designed to sell them on their need of more electric appliances, especially electric ranges and electric water heaters. The direct by mail advertising was followed by newspaper, radio and other forms of advertising—as well as by a consistent

* Advertising Committee: M. L. Cummings, Utah Power & Light Co., Chairman; Gilbert Stanton, Idaho Power Co., Vice Chairman; The Birchard Co., P. T. Birchard; Bozell & Jacobs Advertising Agency, R. H. Wensberg; B. C. Electric Railway Co., J. Lightbody; The California Oregon Power Co., H. D. Kem; Eastern Oregon Light & Power Co., Leon Gray; Gerber & Crossley Advertising Agency, Chas. H. Devlin; Gillham Advertising Agency, Lon Richardson; Grays Harbor Railway & Light Co., F. W. Linklater; Idaho Power Co., Joe Imhoff; McCann Erickson, Inc., Vernon R. Churchill; The Montana Power Co., D. J. McGonigle; Northwestern Electric Co., John Dierdorff; Pacific Power & Light Co., M. G. Kennedy; Puget Sound Power & Light Co., Harvey Leach; Strang & Prosser, Wade Thompson; The Washington Water Power Co., Harvey A. Brassard; Westinghouse Electric & Manufacturing Co., W. C. Miles.

sales program. Results have been exceptional, and have brought the average kw.hr. consumption of customers on the Copco lines far above the national average."

Mr. Jackson pointed out that his company will continue its selective selling of appliances and that, in addition, a new project will begin—a project which faces many public utilities in the United States today—that of selling the public on the idea that private ownership is more to the public advantage than municipal or public ownership.

"Here again selective selling will play an important part," said Mr. Jackson. "It is our plan to appeal to the leaders—the thinking people of our territory—and supply them with definite facts and information, which they, in turn, as leaders, can disseminate to the average persons who do very little thinking themselves. We'll tell our story to the bankers, the newspaper publishers, our stockholders and other leaders in this territory—and urge that they, in turn, present the facts of public ownership and the facts—the true facts of private ownership—to the average man and woman."

The subject of electric water heating was ably presented by Gilbert L. Stanton, Idaho Power Co. He explained his company's program since 1924, which has resulted in 20 per cent saturation in the territory served by his company. He gave details on the appeals used in the well planned advertising water heating campaign which was undoubtedly largely responsible for Idaho Power's excellent sales record on water heaters.

The discussion of radio advertising and the value of radio as a load building factor had a prominent place in the meeting. Round table remarks of the various advertising managers and agency men, clearly indicated that radio is rapidly becoming an important advertising medium.

James Lightbody, B. C. Electric Railway Co., opened the second session of the committee with a paper on the various advertising rackets and promotional schemes, which are a constant worry to advertising managers of every important company in this country today, not only public utilities but all advertisers. He pointed out that public utilities, especially, can't be hard-boiled or unsympathetic because they can't afford to lose friends, but sometimes, in his opinion, public utility executives are misled as to the power of the pen and, as a result, much money is wasted in racket advertising.

Mr. Lightbody also brought out the difference between advertising and donations, and suggested that a complete separation of funds will help solve the problem of having charities

M. L. CUMMINGS

seek funds on the basis of advertising.

The last, but certainly not the least important, subject discussed, was the matter of dealer coordination. I. L. Comstock, The Montana Power Co., took the lead in this discussion by giving details on his company's new merchandising plan. He stated that his company has discontinued merchandising small appliances but will continue to sell mazda lamps, refrigerators, water heaters and ranges.

Montana Power, however, will continue aggressive advertising of all electrical appliances. All promotional advertising now carries the signature "At Your Favorite Store" with no mention of the name Montana Power Co. Small, ten-inch advertisements, however, will be published along side the larger promotional advertisements, with the company featuring appliances over its own signature.

The ensuing discussion indicated that practically all companies are devoting considerable effort toward maintaining favorable relations with dealers.

As a result of the general round-table discussion, the following three suggested activities are recommended for consideration during the year ahead:

1. A more organized effort to merchandise our advertising to our own employes.

2. A systematic plan of interchanging advertising ideas and material among companies in the Northwest.

3. Promotion of increased use of radio, especially in rural communities, where radio program schedules are not available. The overall picture of the radio presents, in our opinion, a lucrative field for developing more load.

The foregoing records a few highlights of the committee's discussions. Other ideas we believe worthy of serious consideration in the future are:

Don't Expect Too Much from Your Advertising

Advertising, coordinated with selling activities, has three definite objectives: (1) to retain present users of our service; (2) to increase use by our present users and (3) to acquire new users.

Blazing the trail, or breaking down sales resistance is the primary job which advertising is supposed to do. Getting the prospect into the store may also be considered as one of its functions. A definite responsibility, however, rests upon the shoulders of the salespeople.

Advertising plows the ground — it even furnishes the fertilizer. It is the job of the sales organization, then, to see that the ground is properly cultivated.

We all know, but perhaps we sometimes forget, that the finest advertising in the world will not create sales to a satisfactory extent without the full cooperation of other activities that build sales. Don't expect your advertising to do the complete job.

Salesmen Should Make the Greatest Possible Use of the Advertising

Advertising is also used to improve the morale of the salesmen. Considerable time, money, effort and thought are given to the production of advertising material which will help the salesman in his work and also indicate to him that his company is backing him up with ample advertising support. The salesman who does not make a regular practice of using this material, of following its trend, of keeping in step with it, of synchronizing his own program with it, is passing up an opportunity of helping himself and his company. He should be urged to study it and should be shown how he can use it effectively in sales contacts.

Conclusion

Company advertising executives and agency men have demonstrated in the past the value of liberal, consistent, well-planned advertising. They are fully aware of the challenge that faces advertising in the coming year. They are mindful of the competition for the consumers' dollar—the increased volume of sales messages in other fields to secure the consumer's attention. They know that the need for soundly conceived advertising is greater than ever before, and that continued and greater success can be assured only by the employment of the best advertising ideas, art work, copy and layout that can be produced.

The constructive ideas and material presented and discussed at our committee meetings are convincing evidence that we will successfully meet the 1938 challenge.

I wish to express my sincere appreciation to the members of the advertising committee for their cooperation throughout the past year, and all who participated in our meeting, for their valuable contribution to its success.

Engineering and Operation Section*

Introductory Statement

FOR the first time in the history of the Engineering and Operation Section an annual meeting was held in Canada in 1938. This, the 15th such meeting, met at the Vancouver Hotel, Vancouver, B. C., April 20-23, with A. Vilstrup chairman. There were 108 registrations from outside, while Vancouver supplied 57, for a total of 165. In addition 24 visiting ladies registered.

Sessions were held mornings and afternoons of Wednesday through Friday. Saturday some 50 delegates availed themselves of the opportunity to visit the Stave Falls and Ruskin Plants of the B. C. Electric Railway Co.

The annual dinner took place at the Vancouver Hotel Friday evening with all the entertainment, music and vaudeville, supplied by employees of the B. C. Co. Another event of the meeting was a lunch on Friday with the Vancouver Electric Club, where the program was given over solely to musical entertainment. Entertainment features and other arrangements were in the hands of a local committee of which C. Arnott was chairman.

At the opening session Wednesday morning, after greetings by His Worship Mayor G. C. Miller of Vancouver and W. G. Murrin, president of the B. C. Electric Railway Co., W. C. Mainwaring, president of the Association, delivered the main address of welcome. Mr. Mainwaring discussed the status of Association finances and its membership, paying particular tribute to the membership committee that had brought in over 75 new Class "B" members. Total membership now numbers over 900, an all-time high in Association history.

He noted certain items of a commercial character on the program of the Utilization Committee and applauded this idea, stating that many commercial problems needed engineering analysis.

He cautioned the group that the utility industry could look for further reduction in rates, since this was the trend of public demand. This situation must be met by cutting expenses and here is where the engineers can prove most useful.

He asked that thought be given to the possibility of holding a public meeting as is done in the P.C.E.A. Many of our troubles come from lack of public understanding and this might be dissipated if we took the public into our confidence more regularly, he said.

Paul P. Ashworth, vice chairman of the Section, responded to the addresses of welcome, accepting Mr. Mainwaring's challenge on behalf of the engineers of the Northwest, urging that an engineering analysis be given to human relations.

Following this opening the six committees of the Section were given an allotted time to present their programs. Each committee chairman presided over his own program. In the following pages the bulk of the papers and discussions presented at the meeting are published. Some of the papers had previously been published in ELECTRICAL WEST, and one is being held for publication in July. (See Table of Contents). In many cases, it was necessary to abstract the papers materially in order to produce them in the space available. There follows a resume of the committee programs in which are noted the papers and reports not published in this issue.

In the program of the Accident Prevention Committee, occupying the balance of Wednesday morning, conducted by R. S. Maxwell, chairman, only the summary of the accident experience of member companies for 1937 is published. The tabulation of the accidents and causes, made available to delegates in mimeographed form, has been sent in this form to all member companies not represented.

On the evening of the same day the committee and others interested met for further discussion, and considered, among other things, the setting up of a first aid contest among member companies.

The Utilization Committee, with Walter Brenton, Chairman, presented its program Wednesday afternoon. The Utilization Devices Sub-committee presented the "Effect of Electric Water Heater on the Distribution System," by Eugene Vinet, which will be published in July. There were also presented a number of short papers on utilization devices, all of which are published herein except the one on "96 in. of Rain Plus Irrigation," by C. B. Greenough, which appears among the reports of the Business Development Section in this issue.

In the program of the Power Production Committee conducted Thursday morning by E. H. Collins, chairman, a progress report on "The Summary of 1937 Electric Fish Screen Investigation," by F. O. McMillan and F. Alton Everest was presented by O. B. Coldwell and distributed in mimeograph form. This report is not published. The paper on "Integral-Furnace Steam Generator," by R. F. Miller was published in the December issue of ELECTRICAL WEST under the title "Station L Boiler Passes 60-Day Test."

Thursday afternoon was given over to the program of the Electrical Equipment Committee with J. Hellenthal, chairman, presiding. Four papers were presented. "Pilot Wire Relay Protection for Puget Sound-City Light Tie Line, by T. T. Smith, appears in the April issue of ELECTRICAL WEST, and "Oil Circuit Breaker Replacements Avoided by Use of Pilot Wire Relays," by R. Rader, was published in the May issue under the title "Breakers Relieved." Two papers of the Operation and Maintenance Sub-committee likewise appeared in the May issue "Reconditioning of High Tension Bushings," by A. E. Frey, and "Six Years of Glass Bulb Mercury Arc Rectifiers," by J. H. Steede.

All of the material presented by the Code Committee Friday morning under M. T. Crawford, chairman, is published in this issue.

Among the papers of the Transmission and Distribution Committee presented Friday afternoon with E. F. Pearson, chairman, presiding, two appear in the April issue: "Review of Present Day Practice in Overload and Short Circuit Protection of Distribution Transformers," by George Westcott, under the title "Saving Distribution Transformers," and "Recent Design and Construction of Transmission Lines in the Northwest" by L. R. Gamble. M. T. Crawford's paper on "Economics of Modern Distribution Design" appeared in the May issue under the title, "Today's and Tomorrow's Distribution Economics."

At the end of this session a talking movie illustrating manufacturing methods and processes in the Okonite factory was shown.

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* A. Vilstrup, B. C. Electric Railway Co., Chairman; Paul P. Ashworth, Utah Power & Light Co., Vice-Chairman; The California Oregon Power Co., J. C. Boyle; Eastern Oregon Light & Power Co., O. D. Lanning; Grays Harbor Railway & Light Co., W. S. Hill; Idaho Power Co., H. M. Jones; The Montana Power Co., A. C. Pratt; Northwestern Electric Co., O. L. LeFever, E. F. Pearson; Pacific Power & Light Co., R. J. Davidson, H. H. Schoolfield; Portland General Electric Co., Walter Brenton, C. P. Osborne; Puget Sound Power & Light Co., M. T. Crawford, J. Hellenthal, R. S. Maxwell, G. E. Quinan; The Washington Water Power Co., E. H. Collins, J. B. Fisken; West Coast Power Co., C. P. Eliot.

Accident Prevention Committee*

1937 Accident Experience

By DONALD W. PRAIRIE
Northwestern Electric Co.

FROM the reports of thirteen member compaines of the Association have been condensed the observations which follow. In these reports were classified the cause of accident, occupation of workman, type of accident, and nature of injury.

The National Safety Council scale of time charges was used for deaths and either partial or permanent disability. Time charged for temporary disability was the actual number of employee's regular working days missed including the carry-over time lost in the following year.

The total number of man hours of exposure was taken from the payroll records when available; if not, it was estimated from the average number of employees and average hours worked per week.

National Safety Council standard rules for computing accident frequency and severity rates were used as follows:

$$\text{Frequency Rate} = \frac{\text{Number of disabling injuries} \times 1{,}000{,}000}{\text{Number of man-hours of exposure}}$$

$$\text{Severity Rate} = \frac{\text{Total days lost} \times 1{,}000}{\text{Number of man-hours of exposure}}$$

The following statistics were compiled from 12 of the same companies reporting in 1936 plus one new company. The 13 companies reported 453 lost time accidents compared with 338 in 1936, an increase of 13.4 per cent against an increase in man hours exposure of 1 per cent, from 21,467,725 in 1936 to 21,681,872 in 1937. Translated into frequency and severity rates, according to the National Safety Council formulae, the average frequency of accidents for the 13 companies reporting was 20.89 per 1,000,000 man hours worked; the severity was 4.035 days lost per thousand man hours of exposure.

The cause of the greatest number of accidents is chargeable to employee responsibility, there being 349 out of 435 in this group including 8 of the 12 fatalities. Carelessness heads the list again with 189 of the 453 accidents or better than 41.7 per cent. Four fatalities fall in this group and the man days lost amount to 26,624. Fifty-one accidents resulting from poor judgment cost one death and 6,854 man days. Thirty-six accidents were listed as "unavoidable." They cost 2 lives and 12,354 man days, counting a fatality as 6,000 days lost. Thirteen accidents amounting to 4,645 man days lost and including one amputated right arm were caused by the inexcusable "carelessness of fellow employee." There were nine accidents each charged to inattention and haste.

Employers' responsibility is charged with 92 or about 22 per cent of the accidents. We find them grouped as follows: lack of proper instructions and training, 18 accidents and 315 days lost; failure of enforcement of discipline, 4 for 6,616 days lost (one death); faulty working practices, 21 for 13,631 days lost (2 deaths); improper working conditions, 11 for 295 days lost, faulty planning and improper methods, 10 for 1,870 days lost; absence of or defective protective devices, 8 for 6,032 days lost (one death); lack of or defective tools and equipment, 20, for 227 days lost.

As usual, the men engaged in the "transmission and distribution" group suffered the most accidents and the most serious ones. There were 258 accidents costing 73,558 man days in this group. All 11 fatalities were in this classification—9 linemen, one truck driver, and one serviceman. There were 127 accidents to linemen alone, costing 60,097 man days. Groundmen were next in point of frequency, having suffered 68 accidents, losing however, only 621 man days. The "generation and transformation" group accounted for 119 accidents and 6,369 man days lost. In this group, the unskilled workers seemed to be the most accident prone —there being 54 accidents out of 119 in the unskilled classifications. Among the "general employees" group there were only 46 accidents costing 777 man days.

There was every nature of injury on the list experienced with the exception of suffocation and drowning. Topping the list with 85 accidents was "contusions"—high in frequency but low in severity, with only 928 man days lost. "Fractures" comes next with 60 accidents and 21,365 man days lost, including 3 fatalities.

There were 51 burns which cost 7,580 man days and one life. It is interesting to note that there were only 11 accidents in the "electric shock" class—indicating a general recognition of the fact that extreme caution is helpful in the presence of extreme danger. Unfortunately, an electric shock sufficient to cause lost time is usually fatal. In this schedule, 7 of the 11 were. One company reported many cases of poison oak infection, stating that every known precaution and remedy was being tried.

The frequency rate still suffers most from "fall of persons" group, in the "type of accidents" classification, there having been 85 of this type of accident out of the 453—almost 18.3 per cent. This type claimed 2 lives. Fifty-four accidents of minor severity happened to workmen with hand tools. There were 32 "contacts with electric current" which, as has been pointed out, took the greatest toll in lives. "Falling objects" shows a record of 38 direct hits resulting in 2 deaths and one right arm amputation.

Thirty-seven men injured themselves by "slipping without falling" for an average of about 13.9 days apiece lost time. Forty workmen lost time for injuries received while handling materials for an average of 9½ days apiece lost time. "Dust and flying particles" put 16 men out of work for about 10 days apiece. "Electric flash" figured in 25 lost time cases for 306 days. Automobiles, apparently more dangerous this year than last, figured in 14 accidents for 219 days lost as against 7 accidents and 86 days lost in 1936.

Our group frequency rate 20.89 for 1937 is almost double that of 1936 which was 11.01. The severity rate shows an increase of almost 81 per cent over 1936 rate, the figures being 4.035 against 2.23.

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Discussion

CAUSES of accidents were discussed by Mr. Maxwell in two major classifications: (1) company's supervisory responsibility, and (2) employee's responsibility.

Under the first he pointed to the many accidents attributable to incorrect or inadequate training. Other accidents indicated companies' contributory negligence. Cited were: failure to en-

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force discipline, allowing hazardous chances and insufficient help, permitting congested passages, false economy, improper planning or defective design, and absence of, defective, or failure to use protective devices or appropriate tools.

Accidents in which the employees' responsibility figured were caused by inexperience , carlessness, poor judgment, physical unfitness, inattention, worry, disobedience of rules and instructions, chance taking, haste, improper clothing or apparel, and carelessness of fellow employees.

Thirty-seven of the 453 accidents in the territory during 1937 were classified as unavoidable.

Gen. H. G. Winsor, Puget Sound P. & L., in his discussion said:

"We should spend more time trying to prevent accidents than we spend reviewing the causes. When the companies suspended some of their maintenance work during the depression, accidents increased. Later we found we had to do more inspecting and more planning. In districts where we carried on more inspection, we had fewer accidents.

"We have an individual responsibility and a group responsibility for accident prevention. There seem to be three places, especially, where we must assert responsibility: namely in preventing disobedience of instruction, lack of supervision, and momentary mental lapse on the part of the worker.

"Our group responsibility is made apparent at such meetings as this. Again we have paid too much attention to what has happened and not enough to what may happen."

Chester C. Coons, Safety Live Line Tool Co., discussed the relation of live line tools to accidents. He said:

"Training is most important in the use of live line tools. We should give a lineman more training before sending him out to work on the higher voltages.

"Care of the tool is also vital. When they are abused they lose efficiency. When they are new and in proper condition, they should stand about 100,000 volts per ft., but tools that have been misused or badly cared for have been found on test to have their resistance reduced to 200 or 300 volts per ft."

Following are notes on discussion from the floor:

O. L. LeFever: One reason for the number of accidents during 1937 may be found in the general weather conditions, since there was more ice during that year than normally.

One way to work safely is to work smoothly, rather than hastily. Sometimes hasty workers make two false moves to one true one. Men should be instructed and trained in maintaining a steady pace.

George I. Drennan: In spite of the emphasis being laid here on looking to the future, it should be said that an examination of experience figures from the past has been valuable in pointing out the dominant causes that should be guarded against in the future.

We are inclined to lay too much blame on the foreman. There is a responsibility on design engineers to design work so it can be built and operated safely. Designers should consult the safety man in the organization when drawing up the plans. We have made progress in this.

E. E. Walker pointed out that the visual form of education on accident prevention might prove valuable in training men. *D. W. Prairie* and *G. I. Drennan* advanced the information that the Metropolitan Life Insurance Co. has a good movie on accident prevention and that the National Safety Council has several reels of film on different phases of this subject. *O. B. Coldwell* told of a sound movie produced by his company on hazards of kite flying.

A. H. Krule referred to the importance of first aid in training to cut down the severity of accidents. He stated that physical examinations were important in bringing to light physical defects that might prove potential accident causes, and, further, had a good psychological effect on the men.

Utilization Committee* — Illumination†

Traffic Safety Lighting

By C. T. BAKEMAN, Puget Sound P. & L. Co., and G. M. BOYD, Westinghouse Electric & Mfg. Co.

TRAFFIC safety lighting is not limited to highways. City streets, arterials and dangerous intersections are involved as well. The term covers lighting wherever needed for traffic safety, and signifies a scientifically designed system, engineered and installed so that traffic can easily see night-time traffic hazards.

Two factors have changed the conception of lighting streets.

1. The Better Light Better Sight Movement.

2. Fast automobile driving. (Car speeds have increased 100 per cent since the advent of the whiteway era.)

Furthermore, the universal use of automobiles and fast driving has produced two new conditions on our streets and highways:

1. They bear state and national, as well as local traffic.

2. They are strewn with dead, dying and maimed persons and with wrecked property.

Of the 106,000 fatal accidents from all causes last year, automobiles lead with 39,700, an all-time record. Majority of these fatalities did not occur in the more congested cities: only 12,300 in cities of 10,000 population or more; 27,400 in rural and small urban areas. Thus 15,100 more people were killed on rural and small town highways than on urban streets.

Of the 39,700 dead, 15,600 were pedestrians, 24,100 were occupants of cars. Taking three, including the driver, as the average number in a car, we discover that approximately 8,000 drivers held the fate of 32,000 people in their hands. What a responsibility upon the eyes and reflexes of drivers!

Last year's total accident bill was nearly $5,000,000,000, made of wage loss, medical expense, insurance, and property loss. Traffic accident costs amounted to $1,750,000,000, about $12 per capita.

The traffic accident rate is growing. Fatal accidents dropped 4 per cent during 1937, compared with 1936, but accidents increased 4 per cent. Since the advent of fast auto travel, there has been an increase of 32 per cent in deaths on urban streets and 180 per cent on rural and small town highways.

But bad as the total traffic picture is, the night time picture is worse. While safety campaigns, safer roads, and car safety devices were saving 312 more lives during 1937 than in 1936, 2,800 more people were being killed at night. The total night-time traffic fatalities were 24,100, but night traffic is only a fourth of the total. That is to say, 25 per cent of the traffic causes 63 per cent of the deaths.

Why this startling difference between

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night-time and day-time accidents? Thorough study shows *poor visibility* to be almost the entire cause.

Poor visibility at night is costly. Take, for example, the comparison of two cities of approximately equal population made by Mr. Simpson of the National Bureau of Casualty and Surety Underwriters.

The per capita cost of street lighting in City A was 82c. The auto insurance premium was $96.80 and the excessive night accidents over daytime accidents for collision, property damage and personal injury amounted to $151,980. City B, with a per capita street lighting cost of $1.24, had an auto insurance rate of $58.45 and an excessive night accident cost of $64,279. The insurance coverage in both cases was the same. Each auto owner in City A was penalized $41.35 for insurance premiums.

In order to have safe visibility at night, we must do what an internationally known street lighting engineer advises: "Match visibility with speed."

Good visibility has two characteristics:

1.—An amount of light adequate to enable the eye to function quickly and easily, and to see far enough ahead. This adequacy must be determined by the need of defective and abnormal eyes and measured by the quantity of traffic.

2.—Proper application of light. An adequate amount of light improperly applied easily defeats the driver's ability to see.

In the application of light to street and highway visibility, two factors have been too frequently overlooked: (1) the eye as such, (2) the direction the light travels from the light source.

We do not see with our eyes. They are really orbs through which light passes, and by means of whose mechanisms that light is focused on the optic nerve. Light stimulates the optic nerve in proportion to its intensity.

The pupil of the eye, which safeguards the optic nerve by regulating the passage of light, cannot open and close fast enough in the street lighting generally encountered today to match present automobile speeds.

Every eye is really two eyes: A central area known as the working area, and a surrounding, peripheral area. The most sensitive parts of the latter area seem to lie below and at each side of the central working area. Intense or raw light striking these parts confuses more greatly than when it strikes the central area. For the shielding of this portion of our eyes, nature has provided us with the eyelash, eyebrow and overhanging forehead.

If we combine these fundamentals of the eye with the principle that an object is seen only by the light reflected from it, we have a rule for light application to produce *safe visibility*.

To illustrate this rule, let us take the example of a small beam of light reflected from an object or street surface —small both because of source weakness and absorption—striking the optic nerve at the same time that an intense beam from the light source does, it is easy to understand that the intense beam will more greatly stimulate the optic nerve than the smaller object-beam and so register more prominently in the brain.

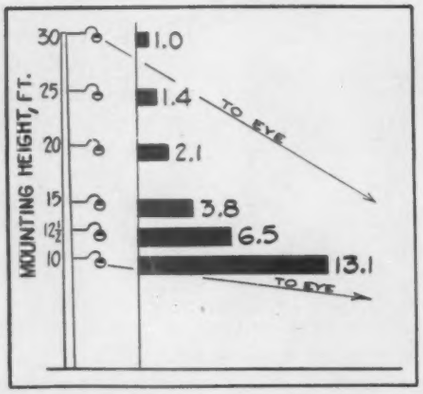

Fig. 1—Relative blinding effect of glare from street lamps

Thus the pupil would close against the intense beam and impede registration of the object-beam. Furthermore, it is quite possible the peripheral area would be so stunned by the intense beam as to cause the eye lids to close or the head to be turned. This explains many accidents at intersections.

Here, too, lies the explanation of why it is so difficult to see during twilight. Brilliant rays from the low horizon, traveling in a horizontal plane, go directly into the eye. Very little light reaches the road surface. The direct rays, stimulating the optic nerve, crowd the rays from the road surface out of recognition by the brain. Reflected rays from a wet or glossy pavement can produce the same effect.

All factors considered, the eye can operate more successfully under lower levels of light when glare is not present than it can under higher levels when glare is present. Hence good visibility is not produced, in inefficient units, simply by replacing smaller lamps with larger ones.

Generally speaking, two methods are used in street and highway lighting:

1.—Lighting the road surface to such brightness that an object may easily be seen in outline. This is known as "Discernment by Silhouette." Here the concern is quick recognition of the presence of an object, and detail is irrelevant. It is successful as long as the traffic is not sufficient to hide the brightness of the street surface.

2.—Illumination of an object with sufficient light to register a definite picture of details upon the brain. This is known as "Discernment by Surface Detail."

The difference should be only in the amount of light applied to the streets. Evenness of street brightness is essential to both systems.

Mounting heights have to do with glare (Fig. 1), and spacings effect the evenness of surface brightness.

The light shielding luminaires have their main beams lower (about 15 to 20 deg. below horizontal) in order to protect the eye. Despite the fact that the light source is more shielded than in previous units, there still remains the possibility of discomfort from the surface brightness of enclosing glassware. This is due largely to the unusual amount of light turned downward by the very efficient reflector used above the lamp. If, therefore, the unit is placed too low, discomfort may result. The unit should be mounted high enough so that when the driver comes into the main beam, overhang of the car roof and the driver's eyebrows and eyelashes will shield his eyes.

From the standpoint of producing visibility, upright luminaires throw but a small portion of light toward the street surface, and that transversely, with the result the street surface does not appear as bright to the motorist as it would if those few rays traveled in his direction.

This statement is particularly true when the pavement is wet or specular in nature, in which case it is very necessary that the unit be so mounted that rays will be reflected in the direction of the driver. A lighting system producing pavement brightness on a wet or specular pavement will also produce pavement brightness on a dry or diffuse pavement.

This law of the angle of incidence equalling the angle of reflection, particularly as it applies to the wet or specular pavement, holds the reason why the automobile headlight, even taking into consideration the polarization of light as applied to automobiles, cannot produce safe visibility.

To obtain safe visibility, so far as our present knowledge goes, there must be a system of fixed lights, properly located, so directed as to be reflected efficiently and sufficiently from street to driver, and so spaced as to produce an evenness of light which is within the eye's ability to use.

Until recently, fundamentals of visibility and traffic safety have been almost neglected. The street lighting which we find today is the result of haphazard evolution.

It is the Why, Where, How Much, and How of traffic safety lighting that will help us discharge our responsibility in this night accident problem. You may say that the Why of traffic safety lighting is primarily a sales proposition and should be the foundation of any street and highway promotional program. It should also be the first consideration in designing and laying out. Our first test of any street lighting

Table I

Studies by R. E. Simpson in 60 cities show the average day fatality rate per M.T.U. (million traffic units), on streets carrying 1,500 automobiles per hr. to be 0.046. The ratio of night to day fatalities on these same streets, according to the grade of street lighting was:

Grade of street lighting (lumens per foot)	Ratio of night fatalities Per M.T.U. to day fatalities per M.T.U.
A, 80 or more	8 to 1
B, 40 to 80	12 to 1
C, 25 to 40	21 to 1
D, Less than 25	47 to 1

plan is: "Will it fill this need of night traffic safety?"

To meet this test requires a combination of lighting and traffic engineering, and no night accident problem is completely solved without this combination.

The fact that the majority of deaths occur on somewhat less than 2 per cent of the nation's road mileage provides a starting point. These sections of concentrated death can be found in the traffic engineer's files. Your city, county, or state traffic officials will have such a record. And wherever there is a predominance of night traffic accidents there is a need for safety lighting. For instance, a 17-mi. stretch of Pacific Highway shows the following 2-year record:

4-mi. inside metropolitan city, poor street lighting, 6 night fatalities.

3 mi.—4 lane highway adequately lighted, no night fatalities.

10 mi. 4 lane highway, no lighting, 6 night fatalities.

Lighting of night accident zones is one way to determine the Where for traffic safety lighting. However, traffic engineering has progressed to the point where it is not necessary to kill a lot of people before installing safety lighting. Wherever a caution signal is needed for day traffic, lighting is needed for night safety. Wherever restricted speed is needed for safety, lighting is needed at night. In fact, wherever there is a mingling crossing or confusion of motor or pedestrian traffic, safety lighting is essential to traffic safety.

After you have determined Where, the next question is How Much. There is abundant evidence to show that the more light, the fewer the night accidents. Table I, covering some 60 cities, shows that increasing the light slightly over three times reduced the excess night fatality ratio to approximately one fourth. Best answer to How Much can be found in the codes on street and highway lighting established by the Illuminating Engineering Society. These set forth the lighting needed in terms of street size and volume, speed, density, and confusion of traffic. Existing installations are hopelessly inadequate and should not be considered in connection with street or highway lighting needs. Your I.E.S. code may require all the way from 4 to 20 times existing lighting levels for minimum safety, but one life saved in a small town can pay for the entire street lighting bill for over eight years. The code must be considered an absolute minimum for safety. It is better to light one or two blocks to code requirements than slightly to improve the street lighting for the entire state. People will be enthusiastic about a small, adequate installation and will demand more of the same kind. A mediocre installation immediately establishes a low standard.

The next problem is the HOW of safety lighting. Since we are not able to provide a volume of light comparable with daylight, we must use the volume available to the best possible advantage.

Modern equipment is designed for definite certain spacing, mounting height, and arrangement. Each type of unit has its own characteristics and these must be considered. The maximum candle power beam should lap well over the beam of the next light. This usually requires a ratio of spacing to mounting height of not more than 5 to 1. Generally speaking, units should be located over active traffic lanes so as to provide a continuous sheen of brightness ahead of the driver. Distribution of lighting should cover the entire hazard area including curbs and intersection approaches so that dangers can be seen before it is too late.

The need for higher mounting cannot be overemphasized. Fig. 1 shows the extra amount of light necessary to compensate for the added glare of lower mounting. With new equipment, mounting heights of 22 to 30 ft. are desirable, and essential to economic spacing.

On curves the lighting units should be located on the outside of the curve and spaced closer so as to provide a pathway of brightness, guiding the driver safely around this hazard. The old theory of putting the lights on the inside of the curve required the driver to look up from the road and be partially blinded by the light in order to tell where the road went. Contrary to popular opinion, it is the brightness of the pavement rather than the brightness of the light that provides visibility and directional guide, even in fog.

The future of night traffic safety and traffic safety lighting rests largely with you people in the engineering and operating departments of the electric utilities. With you rests the engineering and placing of the initial installations. These can do more to sell people on the need for safety lighting than any sales program yet devised.

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Table II—I. E. S. Highway Code

	Pavement Width 2 lanes	3 lanes	4 lanes
Pavement permanently light in color. Lumens upon pavement surface*	of the order of 0.2 to 0.5 lumen per sq. ft. delivered upon pavement surface.		
Illustrative Arrangements*			
Luminaire spacing, ft.	240-250	240-250	240-250
Mounting height, ft.	25-30	25-30	25-30
Lamp lumens	6000	6000-10,000	6000-10,000
Luminaire spacing, ft.	200	200	200
Mounting height, ft.	25	25	25
Lamp lumens	6000	6000-10,000	6000-10,000
Luminaire spacing, ft.	125	125	125
Mounting height, ft.	25	25	25
Lamp Lumens	4000	4000	4000
Darker pavements, oil polished Lumens upon pavement surface*	of the order of 0.3 to 1.0 lumen per sq. ft. delivered upon pavement surface		
Dull black pavements Lumens upon pavement surface*	of the order of 1.0 to 2.0 lumens per sq. ft. delivered upon pavement surface.		

*The illumination on the pavement surface which is here recommended may be obtained in a variety of ways, as by larger illuminants spaced more widely or smaller illuminants spaced more closely. Each example of spacings and lamp sizes illustrates one of several possible arrangements. The best selection of arrangements may vary with local circumstances. The illustrations given are based upon the more common pole spacings, but the growing tendency to separate the lighting poles from the rural line will free the lighting design from such restrictions.

School-Room Lighting

By JAMES C. LITTLEFIELD
Utah Power & Light Co.

MANY school districts, power companies and other interested parties have conducted surveys to determine lighting conditions in schools built 10, 20 or even 40 years ago. Results have shown lighting in keeping with the ages of the buildings. Many were found with no electric wiring whatever. Many school rooms are lighted by one to four bare, 40 to 60-watt lamps, seldom used except by the janitor at night. Teachers have stated that glare from these bare lamps counteracts any benefit.

But even in well lighted school rooms, manual control has often resulted in inadequate use. Teachers have too many other things to do.

We have surveyed many schools on the lines of the Utah Power & Light

ing installed (providing illumination of 6 ft.-candles from semi-direct enclosing globes), we found the lights not burning on a cloudy day and a natural illumination of only 1½ ft.-candles on the inside row of desks.

Wiring in old buildings is woefully inadequate. Further, where the facts of the "science of seeing" are not known we find even new buildings without wiring facilities for adequate artificial lighting.

The color of walls and ceiling is vitally important in any proper lighting installation. Surveys show dark ceiling colors, glossy paints, etc. Maybe some of you have seen as I have, modern school buildings with dark acoustic plaster on the ceiling and light painted walls.

To summarize present conditions; we must agree that the problem is large and that much must be done in educating the educators. Satisfactory conditions can only be obtained by beginning at once on a program of relighting. Every school district should have a budget allowance each year to relight at least one fifth of its schools.

Credit must be given to those farsighted school officials and architects who in the past few years have built school buildings with proper lighting. They have established standards of practice which help to solve the problem of older buildings.

There is still some disagreement on the proper quantity of illumination for school work. This can be answered by the fact that we do not yet know just what the upper limit will be. We do know that benefits continue to increase up to 100 ft.-candles, anything less is a compromise. Lighting engineers seem to agree, however, that 20 ft.-candles for the average class room is justified with higher intensities for sewing rooms and drafting rooms and lower intensities for laboratories and auditoriums. Sight-saving classrooms should have up to 50 ft.-candles.

The best in modern practice in school room luminaires calls for totally indirect or luminous-bowl, indirect types. Any compromise should at least provide diffusing globes, and if of the semi-direct type they should be oversize. The development of cheap Alzac aluminum indirect luminaires and silver-bowl lamps has aided materially in the use of indirect lighting.

In sight saving class rooms and in large lecture rooms, such as are found in universities and colleges, special blackboard lighting must also be provided. This is best obtained by light boxes equipped with control lenses or reflectors recessed in the ceiling.

The development of the photo-electric cell and relay for control of school-room lighting has been one of the biggest advances in the field. It has taken the guesswork and responsibility for conserving eyesight from the teacher. True, it adds initial expense to the installation, but it pays for itself in energy saved when lights are not needed and in eyesight saved when lights are needed.

Its application does not appear to be standardized, but rather to be governed by funds available. Installations vary from two cells per room to one cell controlling the inside row of lights in three or four adjacent rooms. While the former is desirable, it is expensive. One cell and relay per room, to control an appropriate row of light, the other row manually operated, appears reasonable. Whether the inside row is to be controlled or that near the window depends on the direction the windows face. For example, north rooms should have the row of lights next to the windows automatically controlled, as surveys show that seldom if ever is the natural illumination sufficient for the inside row of desks and that artificial lights should be burned during all class work.

East and West rooms are subject to greater variation in natural daylight than any others and could, more than any others, justify two cells per room. However, where only one is used it is best on the inside row of lights.

We many times hear the comment that schools do not need artificial lighting as they are used only during the daylight. To find out for ourselves we installed a photo-electric-cell controlled system in one of our schools on the outskirts of Salt Lake City. The room chosen was on the second floor with southern exposure. The cell controlled the inner row of lights and was set to turn them on when natural illumination dropped below 19 ft.-candles and turn them off when total illumination rose to 41 ft.-candles. The test ran from January to May. Accurate record was kept of weather conditions and kw. demand. Results showed that the inside row of lights were on during 26 per cent of the school hours. The outside row were on only once and then at the request of students on a particularly cloudy day. We feel from this test that automatic control is justified on the inner row of lights in south rooms.

One objection which has been raised to photo-electric cell control is the sudden increase or decrease of illumination when the cell operates. This problem will eventually demand attention. The answer will probably be something like thyratron dimmers to graduate the lamp brightness, and time-delay relays to account for quickly passing clouds. Equipment to do this is available now, but the cost is prohibitive.

Paint manufacturers are doing excellent work in the study of school room wall and ceiling finish. Paints have been developed for application on acoustic plaster which increases its light reflection value without materially decreasing its acoustic property. Studies show that white on the ceiling and pastel shades of blue or green graduating in reflection factor from ceiling to floor are desirable. Paints for both ceiling and wall should be of the flat type to reduce direct glare.

In conclusion, I believe that school officials are to some extent beginning to realize the need for better lighting. It is difficult, however, to convince them that six 500-watt lamps are necessary in the classrooms where ten years ago they installed maybe four 100-watt lamps. Some of this reluctance is due of course to budget limitations. Most school boards honestly attempt to stay within their budgets and in this we can only commend them. But the answer is that the installation and operation of adequate lighting in our schools will add but little to their regular budgets. Further, it will make teaching more efficient, prevent many failures, and conserve the eyesight of our children.

Fig. 1—Average progressive decrease in heart rate as subjects read for one hour under illuminations of 1 and 100 ft.-candles, respectively

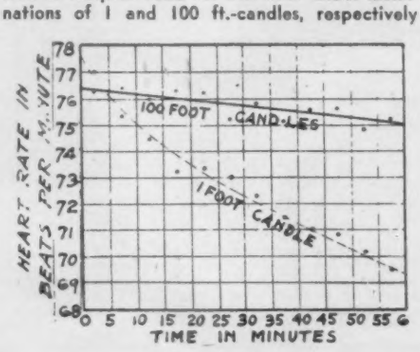
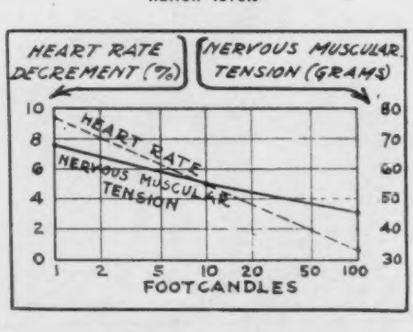


Fig. 2—Heart rate and nervous muscular tension as functions of exposure to various illumination levels



Illumination Levels And Equipment

By F. H. MURPHY
Portland General Electric Co.

IT has been proved that as the level of illumination rises, so does the ability to see clearly and quickly, which is equivalent to making the task easier. However, lighting levels that provide for maximum performance of work are not for that reason the maximum that should be used. Beyond this amount utilized for "doing" ability, the eye requires a certain quantity of light for "waste" energy, that is, for the many physical processes involved in the act of seeing. For low levels this waste energy represents a large per cent of the total energy expended in the act of seeing. As the illumination level rises, the energy used for production increases and the waste energy decreases. At the same time the total energy expended in seeing (production energy plus waste energy) also decreases, and there appears to be ample evidence that the total expended energy decreases even after production ceases to increase, indicating that levels of illumination higher than those necessary for production are beneficial to the eye.

This means that we should not limit illumination levels to those desirable for satisfactory production.

Now, the difference between the total energy expended in seeing, and the total expendable energy of which the eye is capable, represents the factor of safety, and this should be great enough to provide an ample cushion effect for the eye. The total expenditure of energy of which the eye is capable is relatively fixed, and is dependent upon the eye. As the total expenditure required of the eye decreases with increased illumination, the factor of safety increases since the arithmetical sum of the two represents the total expenditure of energy of which the eye is capable. Whether there is a level of illumination beyond which benefits would accrue and the relative expenditure of waste energy for the eye would increase again is not known and there is a definite difference of medical opinion on this matter.

Dr. Louis Lehrfeld of Philadelphia is very outspoken in his opposition to higher levels of illuminaton, particularly those indicated on the light meter.

The majority of medical and other scientific opinion, however, favors the use of any reasonable levels of illumination provided the quality is correct. Dr. Chas. Sheard of the Division of Physics and Biophysical Research of The Mayo Foundation states:

"Although it is well known that eyes are capable of functioning over an extremely wide range of conditions of illumination, there is much experimental evidence to show that such visual adaptation when subjected to exacting tasks and under intensities varying from .01 to .001 of the original environmental intensity (1,000 to 10,000 ft.-candles), may involve severe ocular strain and fatigue accompanied by a drain on the energy resources.

"Ordinarily the maximal output of useful work is reached practically at a level of illumination less than 30 ft.-candles. At very low levels of illumination, useless work is relatively a large portion of the total energy expended in producing a certain amount of work. As the level of illumination increases, useful work increases and finally reaches a limit which is dependent upon other factors than light and vision. There is evidence to show that further increase in the level of illumination makes vision still easier through improved visibility, decreased nervous drain, and decreased ocular strain; hence, human energy and other resources expended in useless work continue to be reduced."

Considerable space in this paper has been devoted to a discussion of the energy required for seeing. It is natural that the question of whether we are dealing with infinitesimal quantities or with quantities of appreciable amount should arise. Dr. Sheard reports as follows:

"Vision is responsible for most of our usefulness and happiness. Adults use their eyes about 16 hours per day. Approximately two-thirds of muscular activities are due to impulses received through the eyes. From surveys of industrial activities, we learn that the eyes are engaged in visual functions about 70 per cent of the time.

"With adequate and proper lighting and with normal eyesight it has been estimated that 25 per cent of the consumption of bodily energy is due to seeing."

What this ratio is for defective eyes and for improper lighting, it is impossible to say, for both of those conditions vary with each individual and each installation. It is sufficient to say that it would mean a very appreciable increase.

That improved lighting conditions do prove of more value to those of defective vision than to those with normal vision is shown by Luckiesh and Moss in their volume, *Seeing*, in which they say:

"The relative benefit derived by those with normal vision and those with subnormal vision from improved lighting is a phase of the science of lighting for seeing which has not yet received adequate attention. . . . However, some data are available on this phase of visual research. A number of subjects were divided approximately into two groups; those with the better vision and those with the poorer vision. The following results indicate the relative increase in rate of working obtained by each group when the lighting was improved by increasing the level of illumination from 3 to 12 ft. candles:

Increase for better eyes.....14%
Increase for poorer eyes.....22%

Applying this in reverse, it is evident that the energy requirement for seeing is materially greater for those with poorer eyesight than for those with approximately normal eyesight.

Luckiesh and Moss have also shown by means of their investigations that the heart beats decrease with time as the eyes are used intensively, but that the decrease is much greater for low values of illumination than for high values (Fig. 1.) They have shown, too, that the ratio of the decrement in heart beats over the range of illumination from 1 to 100 ft. candles is of the same general characteristic as the increase in nervous tension through the same range of illumination (Fig. 2), suggesting that these conditions both originate from a common cause, which only goes to further prove our contention that it takes definitely more energy to read under low intensities of illumination than under high intensities.

These physiological data are summarized in Fig. 3.

These presentations point to the fact that there are humanitarian as well as economic reasons for advancing to higher levels of illumination, and the humanitarian reasons would indicate the desirability of going to appreciably higher levels than would mere economic justification, assuming that the economic reasons are confined to increased production, decreased spoilage, etc.

But looking at the matter from a higher plane, do not the humanitarian advantages concern industry as well, and, if so, would it not seem imperative to broaden the field and include the humanitarian as well as the so-called economic reasons in determining the proper installation?

Leaders in the illumination field are convinced of this.

Another factor that has been of material assistance in raising the level of illumination is the national publicity given to the value and importance of proper illumination to the individual. This has made the public illumination conscious and has helped materially in paving the way for general public acceptance of higher levels and other improvements.

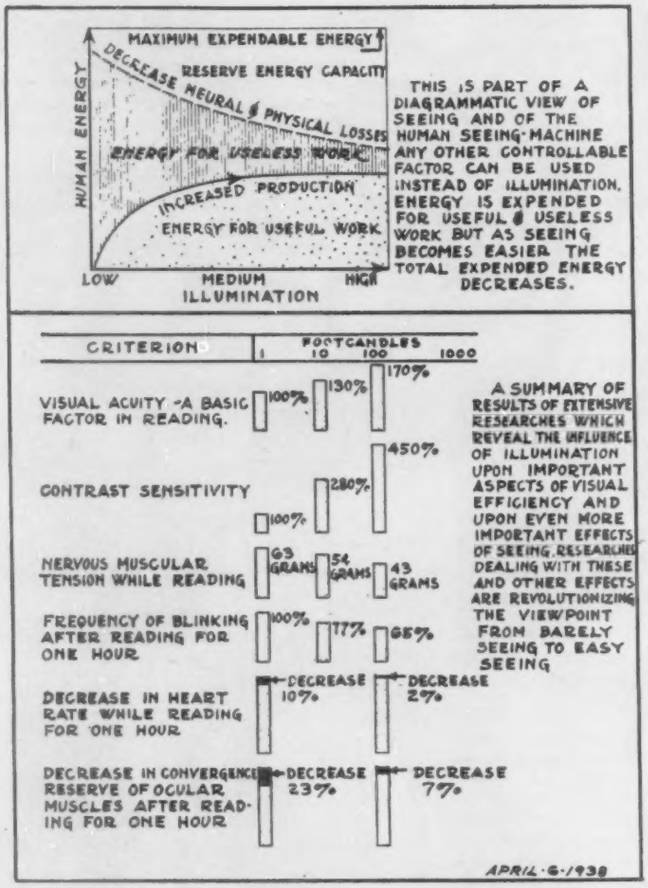

MAXIMUM EXPENDABLE ENERGY
RESERVE ENERGY CAPACITY
DECREASE NEURAL & PHYSICAL LOSSES
ENERGY FOR USELESS WORK
INCREASED PRODUCTION
ENERGY FOR USEFUL WORK
HUMAN ENERGY
LOW
MEDIUM
HIGH
ILLUMINATION
THIS IS PART OF A DIAGRAMMATIC VIEW OF SEEING AND OF THE HUMAN SEEING-MACHINE ANY OTHER CONTROLLABLE FACTOR CAN BE USED INSTEAD OF ILLUMINATION. ENERGY IS EXPENDED FOR USEFUL & USELESS WORK BUT AS SEEING BECOMES EASIER THE TOTAL EXPENDED ENERGY DECREASES.
CRITERION
FOOTCANDLES
1
10
100
1000
VISUAL ACUITY - A BASIC FACTOR IN READING.
100%
130%
170%
CONTRAST SENSITIVITY
100%
280%
450%
NERVOUS MUSCULAR TENSION WHILE READING
63 GRAMS
54 GRAMS
43 GRAMS
FREQUENCY OF BLINKING AFTER READING FOR ONE HOUR
100%
77%
65%
DECREASE IN HEART RATE WHILE READING FOR ONE HOUR
DECREASE 10%
DECREASE 2%
DECREASE IN CONVERGENCE RESERVE OF OCULAR MUSCLES AFTER READING FOR ONE HOUR
DECREASE 23%
DECREASE 7%
A SUMMARY OF RESULTS OF EXTENSIVE RESEARCHES WHICH REVEAL THE INFLUENCE OF ILLUMINATION UPON IMPORTANT ASPECTS OF VISUAL EFFICIENCY AND UPON EVEN MORE IMPORTANT EFFECTS OF SEEING. RESEARCHES DEALING WITH THESE AND OTHER EFFECTS ARE REVOLUTIONIZING THE VIEWPOINT FROM BARELY SEEING TO EASY SEEING
APRIL-6-1938

Fig. 3

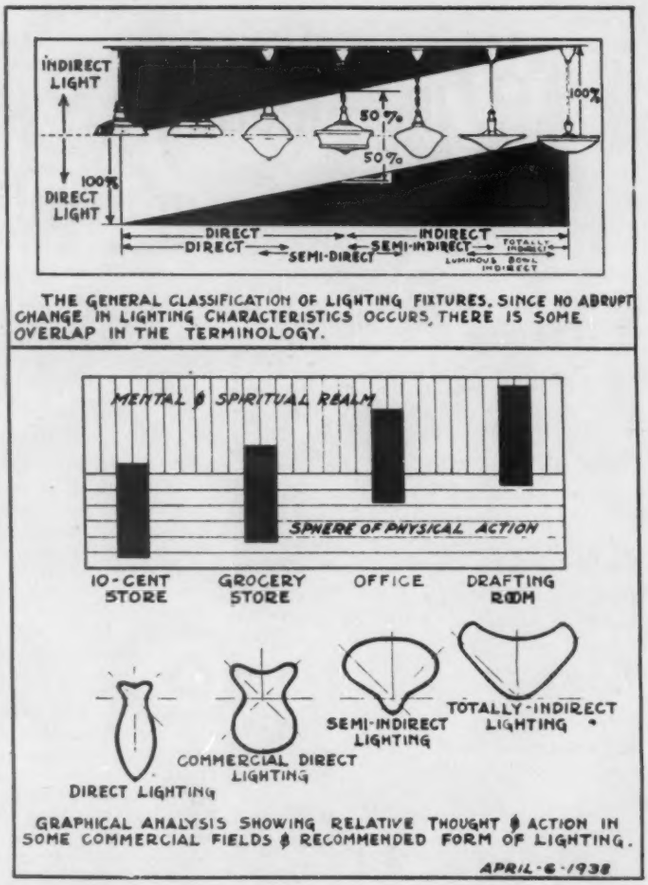


Fig. 4

While these things have been going on, a small but very important piece of equipment has been developed. This is the light meter. And following this has come the visibility meter which now makes it possible for the illumination engineer to analyze the lighting situation for his client by studying the problem from the standpoint of both the work to be done and the condition of his eyes.

In the past the engineer has had no very satisfactory method for measuring either wall reflections or fixture brightness, but there is now on the market a compact instrument which makes either of these measurements directly and accurately.

Thus we complete the third decade with an illumination level that is about 100 per cent above that of the second decade, and this increase is primarily due to (a) expansion of the illumination approach to include humanitarian aspects along with the purely economic advantages; (b) national publicity on the value of proper illumination, and (c) development of practical equipment for measuring light in a simple, direct manner, such that the public can develop confidence in the engineer and his work.

Contrary to the belief of many who have no way of knowing the facts, these constantly rising levels of illumination are not the result of commercial cupidity on the part of manufacturers and central stations, much as they desire and appreciate the increased business, but rather to: (a) development of improved lighting; (b) better knowledge of the science of illumination; (c) development of improved equipment; (d) the development of more definite knowledge of what constitutes proper illumination; (e) education of the public in the value and importance of proper illumination for the protection of eyesight, and (f) progressive decrease in the cost of both lighting units and electrical energy.

The first decade was one of particular concentration upon the physics of light, the second was noted for a concentration upon the economics of illumination, and the third was noted for its attention to the humanitarian phase or the psychological and physiological aspects of illumination.

To sum this matter up then, we might really apply the four successive eras of foot candle usage mentioned by Luckiesh and Moss to the period we have been considering by designating the period of 30 years ago as "Mere light," 20 years ago as "Mere foot candles," 10 years ago as "Production foot candles," and the present time as "Humanitarian foot candles."

As to the lighting equipment necessary to give proper illumination, it has more or less kept pace with the times and particularly has it progressed during this last decade. Basically, it is still divided into four general types known as direct, semi-direct, semi-indirect, and indirect. Formerly the direct was used almost universally, but today the indirect is superseding it in many places. Each has a place to fill. It is the province of the illumination engineer to see not only that the proper quantity and quality of illumination is used but also that the proper equipment is installed.

It has been known for some time that working under indirect lighting was more restful and required less seeing energy than under any other type of artificial lighting and very nearly approached the conditions existing under proper daylight. Direct lighting stood at the other side of the chart requiring the greatest amount of seeing energy.

A chart, combining these properties of the different types of lighting with the natural activities of the user under different types of working conditions, has been prepared by J. Lloyd Kamm of Los Angeles, and appears in Fig. 4.

Discussion

Paul P. Ashworth: Have people in charge of safety on highways undertaken the examination of eyes for men engaged in traffic work?

George Boyd: This type of examination is bound to come in time. Seattle is beginning to take cognizance of the importance of this factor as a cause of traffic accidents.

D. W. Prairie: The Northwestern Electric Co. has examined the eyes of its men for some time, and has found that men working outside have uniformly good eyes while the eyes of men confined in doors, as for instance steam plant employes, are subnormal.

O. L. LeFever: Is it not true that too much light is bad for the eyes?

F. H. Murphy: Studies seem to point to the truth of that statement because in dealing with artificial light indoors there are so many factors that are not present in normal daylight oudoors. For instance, ceiling brightness and heat and the quality and distribution of light indoors are factors limiting the quantity of light that is best for the seeing task. Under ordinary conditions about 50-ft. candles is as far as we now want to go in most cases.

George Boyd: We do not see with our eyes. Seeing depends on the light striking the optic nerve. We must make it strike this nerve in the proper way.

Murphy: Energy is required for each visual impression and it is this use of energy that tires us after a hard day's use of the eyes.

Responding to a question as to the response of state highway commissions to the demand for highway lighting, *Murphy* and *C. T. Bakeman* brought out that both the states of Oregon and Washington were seriously considering this subject. The state of Washington is watching the Tacoma experiment, which has proven successful in reducing accidents and they expect to continue lighting other sections of highways as funds permit.

Utilization Committee—Devices*

Effect of Range Load on the System

By R. RADER
Puget Sound P. & L. Co.

IN 1926 the Electric Range Committee of the National Electric Light Assn. presented a range survey made in 1925, which is the most thorough of its kind ever made. Tests were conducted on groups of ranges on the lines of three Northwest companies, from which the characteristics of the electric range load, as it then existed, were quite well established. The conclusions reached at that time were:

1. The electric range load is good business for the power company which has a rate to support it;
2. The electric range raises the load factor of the average domestic customer from 12% to 22%;
3. Investment to serve range load decreases quite rapidly as saturation increases.
4. Use of the electric range paves the way for other current consuming devices.

The report acted as a stimulant to range sales which are even now gaining impetus. During 1937, approximately 450,000 ranges were sold in the United States, which was three times the number sold in 1929.

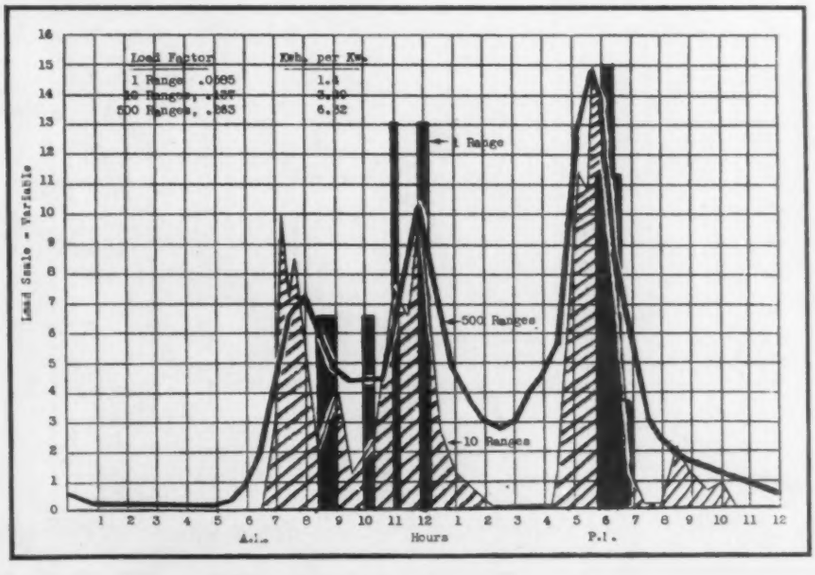
From time to time since 1926 a few individual companies have made analytical studies to determine the advantages or disadvantages of the electric range as a load builder. However, establishing system costs and revenue applicable to a single type of appliance is difficult, and there remains considerable doubt in the minds of many executives as to how extensively this load should be developed. The purpose of this paper is not to solve this problem, but rather to present some characteristics of the range load which, when studied in conjunction with the system load, may assist the engineer in his detailed analyses.

Fig. 1 shows range load curves. Curve 1 is for a single electric range. No two load curves of individual ranges would be exactly alike, though the load factors of all would be quite low, ranging from 3 to 6 per cent. As additional ranges are added, the load factor gradually improves. Curve 2 shows a typical combined load curve of ten ranges, the load factor having increased to approximately 14 per cent. Curve 3 is a load curve of 500 ranges, load factor 26 per cent. These curves were plotted to different vertical scales to give the same peak value for each curve, so that the improvement in load factor is readily apparent.

This curve for 500 ranges was obtained by combining test data on ranges tested in various parts of the country, including some recent tests by West Penn. Power Co. This represents data from city residential areas, apartment houses, rural areas, small towns, industrial areas, etc., blended together to obtain a closer representation of the shape of the system load than could be obtained from a test group of 50 or 100 ranges.

The shape of the range load curve has changed considerably since the

Fig. 1—Typical daily range load curves for 1, 10 and 500 ranges



* O. D. Lanning, Eastern Oregon Light & Power Co., Chairman; B. C. Electric Railway Co., E. E. Walker; The California Oregon Power Co., R. S. Daniels; Idaho Power Co., O. C. Mayer; The Montana Power Co., E. W. Williams; Mountain States Power Co., Z. E. Merrill; Northwestern Electric Co., Corbett McLean; Pacific Power & Light Co., J. E. Yates; Portland General Electric Co., A. H. Greisser; Puget Sound Power & Light Co., Geo. Palo; Utah Power & Light Co., A. C. Kelm; The Washington Water Power Co., H. C. Bender; West Coast Power Co., C. P. Eliot; Westinghouse Electric & Manufacturing Co., L. G. Fear.

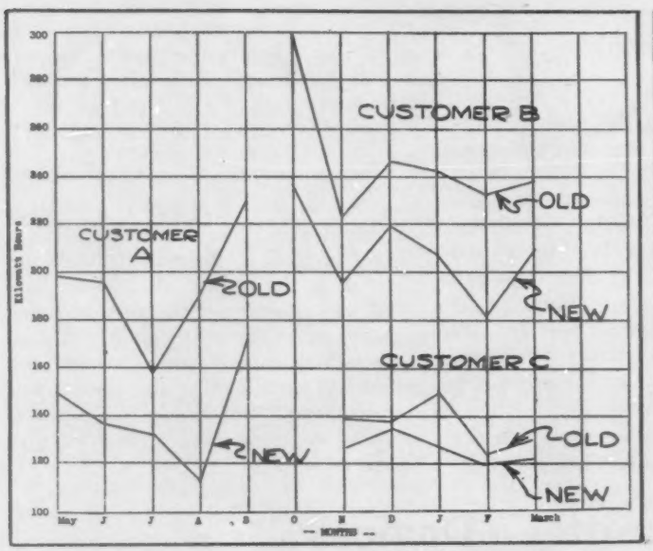


Fig. 2—Comparison of consumption of old and new electric ranges

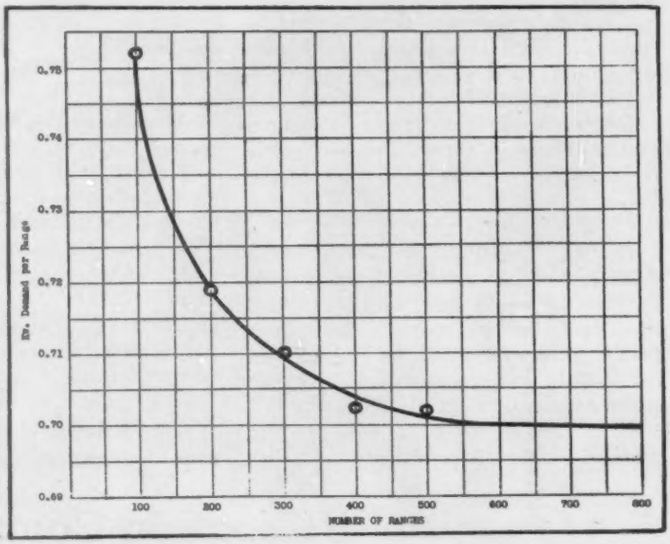


Fig. 3—Range demand as a function of number of ranges in group

earlier tests, later data showing a marked improvement in load factor. This is credited to several factors, including:

(a) Increased use of ranges by industrial classes, farmers, etc., producing wider diversity in cooking hours.

(b) Shifting of the cooking hours through economic changes, including shorter hours, and a greater tendency to patronize public eating houses.

(c) Improvement in range design, including more wattage, better efficiencies and more flexibility in control of the heating units.

For example, the modern range has a total of 18 switch positions giving greater refinement in heat application.

The average rating of modern ranges will exceed 8 kw., some units being rated as high as 15 kw. However, the increase in wattage has not caused an increase in demand or in consumption of an average individual range. On the other hand, the net effect of improvements has been a reduction in average consumption from an earlier figure of around 1,500 kw.-hr. per year for a range in active use, to a present average of about 1,350 kw.-hr. per year.

Due to this changing status of the electric range since the 1925 survey, the time is now opportune for the individual power companies to make a check-up of the facts concerning this major appliance. They should know the answers as applying to their own system to such questions as:

(a) How much revenue does the range produce?

(b) How does the range revenue compare in dollars per kilowatt year with other appliances?

(c) How does it compare with the average cost per kilowatt of the total system load?

(d) What comparisons can be made to determine whether the range load brings in sufficient revenue to warrant extensive sales effort for further expansion?

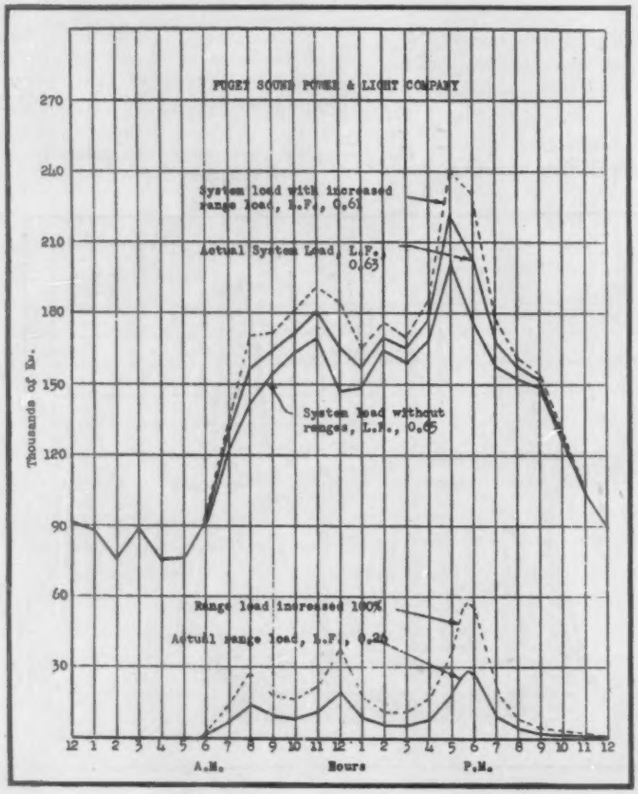

PUGET SOUND POWER & LIGHT COMPANY
System load with increased range load, L.F., 0.61
Actual System Load, L.F. 0.63
System load without ranges, L.F., 0.65
Range load increased 100%
Actual range load, L.F., 0.28
Thousands of Kw.
A.M. Hours P.M.

Fig. 4—Typical system load with range load indicated

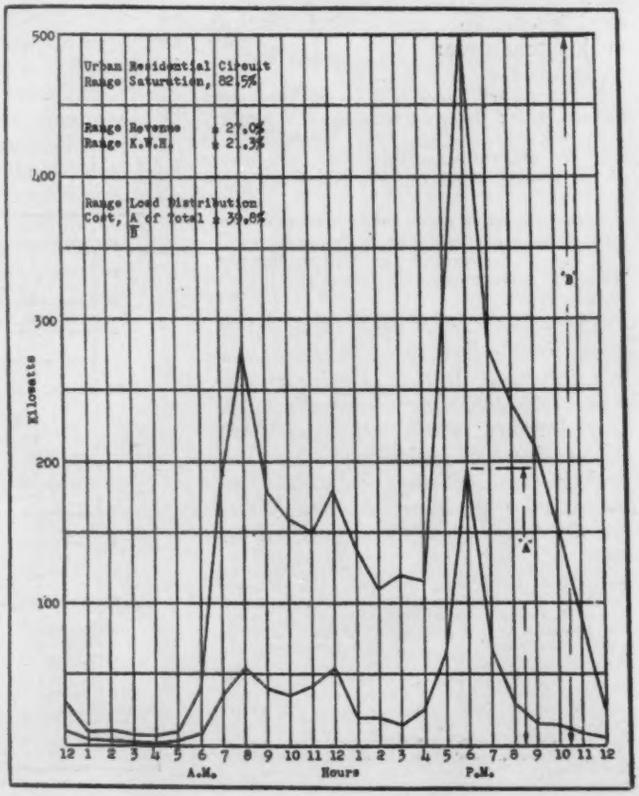


Fig. 6—Typical distribution range load curve

Fig. 5—Effect of range load characteristic on generating capacity

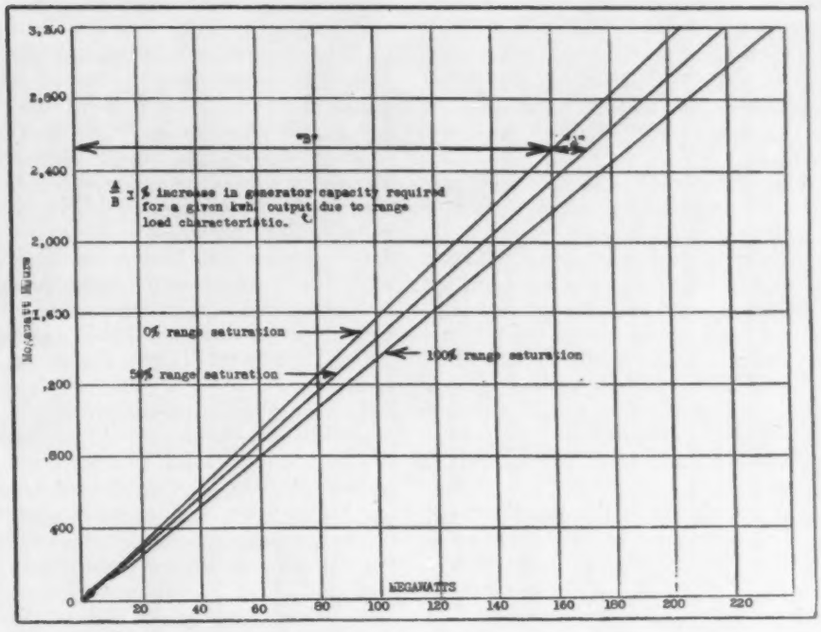


Fig. 2 shows the energy consumption in three different homes, of electric ranges of the vintage of 1924, compared with the energy consumption in the same homes after the old ranges were replaced with modern ones. The comparisons are for corresponding months in each case, and represent as nearly similar conditions as possible. In these homes, the installation of the new range was the only change made in electric appliances, with not even the purchase of an I.E.S. lamp. Moreover, no changes were made in number of occupants, and living conditions continued on the same plane. These were the first three cases found which met the requirements, and though the data are not conclusive, they bear out the findings of other investigators. The reduction in use is very consistent and shows a net average decrease in consumption of 17 per cent due to the better characteristics of the new ranges.

The ratio of the average number of ranges in active use per day over a period, to the total number of ranges connected, is called the "use factor" of the group. For the Puget Sound system this figure is believed to be approximately 0.833. This figure was accordingly used in determining the system range loads given in this report.

Fig. 3 shows the decrease in the maximum demand per range as the number of ranges in the group increases. The curve was drawn from basic test data, using average values. For example, the kilowatt demand per range for a group of 200 ranges is the average of all the possible combinations of tests on six groups of 100 ranges, taken in pairs. The results indicate that the kilowatt demand per range decreases very slowly for groups larger than 600, so that for a group of several thousand ranges the average kilowatt demand per range would be approximately .695 kw.

In Fig. 4 is shown the Puget Sound system load for a typical December day, 1937. The lower curve shows the system range load of 41,000 customers representing a residential saturation of 25.5 per cent. Average monthly consumption per range (connected) is 103 kw.-hr. Assuming a 20-per-cent energy loss between generators and customers, the monthly generation per range becomes 128.5 kw.-hr. The system load factor on the particular day shown is 0.63, while the load factor of the range load alone is 0.26. If the range load were removed, the system load factor would be increased to 0.65, and if the range load were doubled the load factor would be reduced to 0.61. Thus the range load has a detrimental effect on system load factor, due to the range peak occurring almost at the time of the system peak. The range peak occurs at 5:45 p.m. in the Northwest, and there is very little seasonal variation. On the other hand the system peak for the several companies or for an individual company will vary not only in time of day but may occur in different months. However, December is predominatingly the heaviest load month, hence was chosen.

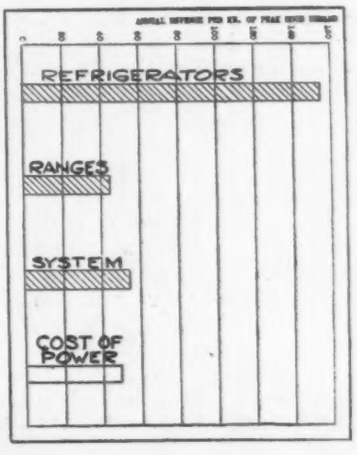
In load curves for the other Northwest systems it is noteworthy that as range saturation increases, a larger and larger amount of generating capacity is required per kw.-hr. output. This is illustrated in Fig. 5 where the Puget Sound Power system was used for basic data. For a range saturation of 50 per cent, generator capacity required per kw.-hr. of load has increased 6.8 per cent over the requirements with zero range saturation. This same comparison would hold for any total value of system load provided the load should increase in proportion to the number of residential customers.

Fig. 6 represents the actual load on a city distribution circuit, with heavy range saturation (82.5 per cent). Range load was segregated from total load using basic range data. Range revenue amounts to 27 per cent of the total feeder revenue, as determined from the rate schedule. In arriving at this figure the first 51 kw.-hr. were assigned to lighting and small appliances, the next group being assigned to the ranges. If the distribution costs are allocated proportionally to demands at time of the peak, then the range load is responsible for 39.8 per cent of the distribution cost. Here again the range load is not bearing its pro-rata cost.

It is quite evident from the preceding curves that the range load, when considered by itself, and assigned its pro-rata portion of system cost, does not bring in sufficient revenue to justify the promotion of range sales. To illustrate further, let us assume that the range revenue will average 2.6c per kw.-hr. for the block following the first 50, which is a fairly representative value. Now, if we assign to refrigerators the next block, the refrigerator revenue will average, say, 2c per kw.-hr.

Applying these rates to typical range and refrigerator load curves, we find that the revenue per kilowatt of demand at time of the system peak is $45 for the electric range load, and $155 for the refrigerator load (Fig. 7). This value of $45 is less than the cost of

Fig. 7—Revenue and cost comparisons per kw. of peak demand



power on most systems. Does this mean then that the range load is undesirable at prevailing rates? Not necessarily. The key to this situation lies in the fact that the range holds the key position in the development of other appliance loads.

For example, the electric range can almost be considered as the creator of the electric water heater, and when the combined load of these two appliances is considered as a unit, the resultant load factor and the revenue per kilowatt of demand takes on a more pleasing characteristic. Before the advent of the electric range, the residence load was so feeble that it was often not considered worthy of extensive promotion; but with all the modern appliances the residence load is no longer a weakling.

The popularity of the electric range is on the increase. In 1929 there were ten gas ranges sold to one electric range. In 1937 only four gas ranges were sold to one electric range. The residential load is now and will continue to be a major factor in shaping the system load curve, so that analyses of this load and its component parts will require the increasing attention of utility engineers.

●

Air Conditioning Trends

By J. E. YATES
Pacific P. & L. Co.

AIR conditioning has as its main objective, increasing human comfort. There are many different pieces of equipment manufactured today and marketed as air conditioning equipment, most of which require electric power for operation, so that we, of the electric fraternity, should be awake to this new industry. Air conditioning can be broadly divided into two main divisions, winter conditioning and summer conditioning, depending on the type of service to be rendered. When these services are combined, all-year air-conditioning service is rendered.

When we consider that the results to be obtained by this equipment are directed solely toward increasing human comfort and that today it is possible to furnish any designated condition of air within a given space, any condition of temperature, humidity, purity and motion desired within wide limits can be supplied. A recent technical publication announced the construction of an electric lamp, the light from which will kill microbes and germs almost instantly. Imagine the contribution to human comfort from a health standpoint which this device will make when installed in the air duct of a forced air heating system.

It is conservatively estimated that at the close of the year 1937 there were installed in the United States 1,000,000 hp. of air conditioning equipment requiring 750,000,000 kw.-hr. annually. During the next 10-year period it is estimated that the connected load of air conditioning equipment to be sold will increase ten times. That being the case, we in the Northwest should give thought to the type of load and its relative location on our distributing lines so that we will not be totally unprepared when it comes.

Present energy consumption of air conditioning equipment is in the order of 750 kw.-hr per hp. per year, which is equivalent to an annual load factor of 11.4 per cent. Refrigeration requirements for summer cooling account for more than one-half of the connected load and about 50 per cent of the annual consumption. Fans and auxiliary equipment account for the balance. This is not a desirable load from a utility viewpoint because it will operate over the daily peak, particularly so in the Pacific Northwest where operation of cooling equipment in the late afternoon is advisable to remove the heat stored in the building by the sun during the day. The use of winter conditioning equipment does not present so severe a problem because the relative sizes of motor-driven heating and air circulating equipment are not so large.

The first use of commercial air conditioning equipment in the Northwest will be by hotels, restaurants, theatres, hospitals, specialty shops and similar businesses where comfort can be capitalized to the owner's advantage. Residential installations will be confined to the better residential districts. These load locations are not attractive from our standpoint because in both commercial and residential locations heavily loaded facilities will be called on to deliver the added power.

Some thought is being given nationally to the problem of refrigeration storage. This will require some method of cooling the refrigerant during daily off-peak periods on the utility's system and holding the cooling medium until required. Such a plan will materially improve the load factor of the air conditioning equipment and from this standpoint is very desirable for utility systems, but it has disadvantages from the customer's viewpoint because it will require more space and increase the first cost. These disadvantages might be offset to some extent in certain conditions by compensating rates for off-peak service.

Time does not permit the full development of the subject. It is introduced at this time so that some consideration of it can be given. We should therefore be alert to the situation so that as the air conditioning industry expands we may be able to serve it advantageously to all concerned.

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Air Conditioning Observation

By R. S. DANIELS
California Oregon Power Co.

THE value of air conditioning as a hot weather business stimulator for stores, shops, hotels, and restaurants has been conclusively proved. Installations of air conditioning equipment already made in such establishments have confirmed what the motion picture theaters discovered—that good air builds business.

In southern Oregon and northern California the humidity is not excessively high and high temperature periods do not exceed two months duration. The motion picture theaters were the first to adopt air conditioning in this district. In localities where the water temperature was not over fifty deg. good results were obtained when using water cooling coils. When the water was above 50 deg. and spray systems were used, the high relative humidity of the conditioned area made things worse instead of better.

Aggressive load building activities of the utility companies have brought us face to face with the necessity of furnishing to our customers reliable and concise estimates of operating costs and equipment costs for contemplated installations of air conditioning equipment. There have been instances where refrigerated systems have been installed and the water cost for cooling the refrigerant, together with power costs, have exceeded the expectations of the customers.

A merchant in the territory served by our company recently installed mechanical refrigerated air conditioning using a total of 7½ hp. At the end of the first season, after two and a half months operation, it was found that 6,754 kw.-hr. were consumed. The cost for power averaged nearly $60 per month, but was not out of line in the mind of the customer nearly so much as $20 to $25 per month for the cost of water used for cooling the refrigerant. The water cost was high largely because the temperature of the supply water averaged about 65 deg. Next year his full season will be about 3½ months with a consumption of about 9,500 kw.-hr. at a cost for the season of about $200.

Listed below are typical installations

of water cooled systems, spray and coil, together with the kw.-hr. consumed for the seasons operations:

Restaurant—5 hp. blower (water coils) 4,100 kw.-hr.

Hotel—7½ hp. blower (water spray) 6,000 kw.-hr.

Department store—15 hp. blower (water spray) 5.850 kw.-hr.

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Air Conditioning Submeter Tests

By H. C. BENDER
Washington Water Power Co.

FOLLOWING is the result of a full year's test on the current consumption of a furnace, filter-blowers and automatic heating equipment.

In the fall of 1936, 20 accounts were chosen for analysis of the use of air conditioning equipment. One account was an 8-apt. apartment house using forced air and automatic heat. These apartment house data have been kept separate. Test meters were installed on 19 residential accounts. Among these were 6 customers using an oil burner in connection with furnace blowers and 7 customers using stokers with furnace blowers. The oil and coal consumption for these accounts was secured from the customer and these were totaled to determine the relation of kw.-hr. to fuel oil used. These figures show an average current consumption of 15 kw.-hr per 100 gal. of fuel oil and 20 kw.-hr. per ton of coal consumed.

Table 1 lists the total bill in kw.-hr. consumption by months for the 19 accounts as well as the kw.-hr. consumption by months for the furnace filter-blowers, stokers and oil burners. There were 4 of the accounts in which the furnace-blower was used during the summer for cooling purposes. These accounts ran from 470 kw.-hr. to 836 kw.-hr. showing an average of about 600 kw.-hr. used in these blower units. The accounts not using the blower for summer cooling ran from 150 kw.-hr. to about 400 kw.-hr. The average of all the accounts as noted being 341.7 kw.-hr. for the filter-blowers. If we take out the four accounts using their equipment for summer cooling the average becomes about 272 kw.-hr. This indicates that the yearly consumption of 600 kw.-hr., where cooling is used, is nearly 2¼ times the consumption where the units are only used during the winter heating season. It is apparent that out of the total installations of the equipment there are very few who make use of the summer cooling.

The apartment house account has the same size motor on the blower as most of the domestic units, ¼ horsepower, but the consumption was 1,560 kw.-hr. for the season. This unit shows a consumption during August and September of 106 and 130 kw.-hr. respectively with about half this during the two months before and after, indicating a very definite summer use and a longer daily use than any of the other accounts.

The columns headed by percent (%) of schedule No. 1, Column 9, 10, and 11 indicate that from November to May the amount of current consumed in the air conditioning equipment is quite sizeable percent of the total current consumed in these homes under schedule No. 1.

The maximum for automatic heat and filter-blower being 31.8 per cent of schedule No. 1 consumption as indicated in Column 11. This column also indicates very clearly the small use made of this equipment during June, July, August, September and October. This points out again the necessity of carrying on some activity aimed at boosting this summer use of the blowers for cooling purposes.

The yearly averages for automatic heat and filter-blower units indicates the growing importance of this equipment as a load builder for our company. From our records there have been installed since 1933 approximately 900 filter-blowers and 900 stokers in Spokane only. Assuming 31,000 residential accounts in Spokane and not over half of them with furnaces it would indicate about 15,500 furnaces, 900 of which have blowers. This indicates a saturation of a little less than 6 per cent and a large potential market.

Stokers and oil burners had several years start on filter-blowers. Stoker sales show a continuous growth with an estimated saturation of only around 10 per cent. Many oil burners have been replaced by stokers, so an estimate of the saturation of these units is difficult. There have been about 300 units installed since 1932. The few left in at this period, January 1933, plus those sold since that date, would indicate a saturation of around 3 per cent. The total automatic heat saturation of about 13 per cent shows a very substantial market still available.

Another interesting angle to this study is that this large potential residential load is available without a cent of cost for additional distribution.

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Dairy Water Heater

By A. C. KELM
Utah Power & Light Co.

SEVERAL years ago, an ordinance was passed in Salt Lake City requiring dairymen who sell milk to use hot water in connection with their operations. The water was to be heated in a milk house, which had no direct connection with the residence. The provision was made to prevent contamination of the milk.

This made it necessary to provide some independent source of heating hot water, other than that used in the house. On large farms, equipped with piped water supplied from a pump, this requirement could easily be met by the use of the regular type of electric

Table I—Domestic Winter Air Conditioning—Submeter Test

Average of 19 Customer Accounts Including 19 Filter-Blowers — 7 Stokers — 6 Oil Burners

1	2	3	4	5	6	7	8	9	10	11	12	13
Heating Season 1936-1937	Total Bill Sch. 1	Average of 19 Filter-Blowers		Average of 6 Oil Burners		Average of 7 Stokers		Comb. Percent of Total		Blower & Auto Htg. Average	Sch. 21 8 Apt. House	
								Blower Oil-B.	Blower-Stoker	Percent of Total Bill		
	Kw.-hr.	Kw.-hr.	%	Kw.-hr.	%	Kw.-hr.	%				Blower	Stoker
June	182	7.2	4.0	5.0	2.7	7.0	3.8	6.7	7.8	7.2	48	18
July	188	7.0	3.7	1.6	—	2.3	—	4.6	5.0	4.8	56	6
August	190	11.3	5.9	1.0	—	.6	—	6.5	6.3	6.4	106	2
September	211	9.7	4.6	.7	—	.6	—	4.9	4.9	4.9	130	2
October	233	11.5	4.9	9.5	4.1	10.3	4.4	9.0	9.8	9.4	42	16
November	261	23.4	9.0	16.8	6.4	22.0	8.4	15.4	17.4	16.4	82	34
December	329	44.1	13.4	36.0	10.9	31.5	9.6	24.3	23.0	23.7	174	66
January	356	50.4	14.2	41.7	11.7	32.2	9.1	25.9	23.2	24.5	206	80
February	398	74.2	18.7	60.4	15.2	44.3	11.1	33.9	29.8	31.8	254	148
March	327	45.7	14.0	40.7	12.5	32.1	10.0	26.5	24.0	25.2	202	116
April	281	32.7	11.6	27.7	9.9	22.6	8.0	21.5	19.6	20.5	136	70
May	271	24.5	9.1	22.3	8.2	19.3	7.1	17.3	15.3	16.3	124	56
TOTAL AVERAGE..	3227	341.7	10.6	263.4	8.2	224.8	7.0	18.8	17.6	18.2	1560	614
Average of 4 Accounts Using Blower for Summer Cooling:	4091	601	14.7									

Note: (%) Columns are all percent of Total Bill (Sch. 1) kw.-hr.

water heater. On the smaller farms, however, where all of the water was pumped by hand from a well, this requirement was difficult to meet.

To help these farmers, Utah Power & Light designed an electric dairy water heater which consists of an insulated tank about 15 in. in diameter and 16½ in. high with a capacity of approximately 5 gal. The outside of the tank is made of a copper-bearing galvanized iron, not lighter than 27 gage. The inside of the tank is made of 14-oz. tinned copper. There is a 1-in. space between the inside and outside of the tank, which is filled with rock wool insulation. The top of the tank has a removable lid, which is also insulated with the same thickness of insulation as the walls.

A 230-volt, 1,000-watt, bayonet-type heating element is screwed into the side of the tank near the bottom. The faucet for draining the hot water is placed 4 in. above the bottom, so that the heating element will always be immersed in water.

The heating element is charged from a 115-volt supply, at which voltage it draws 250 watts. In using this type of heater, it is necessary to fill the tank by pouring the water in at the top. If a full tank of water is used twice a day, the heater may be left on all of the time and no thermostat is necessary.

With the special rate which is provided for this type of water heating, the cost of operating the heater varies from $1.35 to $2.00 per month. If the heater is left on continuously, the cost will not exceed the upper figure. The heater is generally connected to the customer's wiring through a submeter to the house meter, and the consumption shown on the meter to the water heater is subtracted from the consumption shown on the house meter.

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Stock Tank Heater

By A. C. KELM
Utah P. & L. Co.

DAIRY cattle must drink plenty of water if a high milk production is to be secured. It has been found that the water temperature has little influence on the milk production, providing feed and shelter protection permits the animals to make up for the heat needed to warm the water consumed. However, it is generally conceded that it costs less to heat drinking water with electricity than to heat the same water with high-priced feed concentrates, which are necessary when the dairy cow is required to heat her own water.

A very inexpensive and effective stock tank heater can be made from 60 ft. of standard soil heating cable and two pieces of ½-in. mesh hardware cloth of such a size that they will fit the bottom of the tank. The cable is woven back and forth and fastened in between the two layers of hardware cloth, and is thus held rigidly in place. The two ends of the cable are carried out of the tank and connected to a 115-volt supply.

This heater will consume 400 watts, and will warm the drinking water so that it will be suitable for drinking purposes. In order to conserve the heat as much as possible, the tank should be placed in such a location that it will be sheltered from the wind, and the outside of the tank should be insulated with straw.

This type of heater may also be used for warming drinking water for chickens. In this case the troughs will be much smaller, and the cable may be used to heat a number of troughs by cutting the 60-ft. length into smaller sections and connecting them all in series across a 115-volt circuit.

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Attic Ventilation

By R. S. DANIELS
California Oregon Power Co.

SOME three years ago this company sponsored a promotional program on attic ventilation. While the day temperature may run around 100 deg. F. with a relative humidity of approximately 25 per cent, the nights are generally cool. These facts make possible the use of attic ventilation, and this type of cooling for the home is proving popular.

Manufacturers now offer equipment as a package unit which sells for approximately $100 to $125, and is of sufficient capacity to take care of the average small home allowing 25 to 30 air changes per hr.

The attic temperature together with the temperature of most buildings at seven p.m. is extremely high. By employing the attic fan it is possible to draw the house temperature down to approximately the outside temperature within a few minutes.

One home in this district installed a quarter horsepower fan which serves as a home cooling system in the summer and is used in connection with heating equipment in the winter. Twelve months use of this equipment indictates an increased total use, most of which increase must be occasioned by the fan, and which amounts to 275 kw.-hr. Another example is that of an attic fan installed in an average size home and used two months during the summer, with an increased use of 50 kw.-hr.

It appears that acceptance is here for attic cooling due to the low cost of operation coupled with the fact that equipment costs are not excessive and the equipment is quiet, slow in speed, and provides sufficient air-changes to effect actual cooling in the home.

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Ventilation

By U. K. PETERSON
Northwestern Electric Co.

PROPER ventilation is governed by the season of the year, the time of the day or night, the type of establishment, and the number of persons who will occupy the ventilated space at one time. Air inlets must be so located that there will be a free flow without draft, the air being neither too hot nor too cold. Air outlets must be so placed that the used air will be exhausted to the atmosphere without causing undue discomfort.

Many specifications have been written for the recirculation of some or all of the air in a given space in order to create an even temperature and distribution of the air at the temperature best suited for the space and occupants. Recirculation of air is unsatisfactory because the humidity will be lowered and the air will become contaminated, promoting propagation of disease germs and thereby returning to the space a greater hazard. The only method to combat this hazard is that of heating the air above the temperature suitable for propagation of disease germs, and then cooling it to a useable temperature.

In any space the dangerous gases will be found on or near the floor or floating on particles of dust. These particles are drawn back into the air system when recirculation is used. Heating or cooling the air will very seldom remove these gases or germs which frequently lodge in the equipment and ducts ready to be transferred into the space which is being ventilated. Cleaning will help, but most systems are not adapted to thorough cleaning because the pipes, placed in the walls, are difficult to reach.

Cities with large and closely built buildings generally have two major places from which air is admitted and to which air is exhausted for ventilation purposes,—the courts, and the sidewalk street entrances of the buildings. Air from the sidewalk level usually contains gases and disease germs, as well as dust particles. Courts have very little, if any, circulation of fresh air. So, fresh air is at a premium, although it is free. Buildings which secure the major portion of the air from these two sources seldom obtain a complete

change of air more than once in twenty-four hours, even though the doors and windows may be opened in an attempt to obtain fresh ventilation.

In spaces heated by steam or hot water, and which do not have free circulation of fresh air, the moisture in the air becomes dissipated unless there are large numbers of persons in the space. With a large number of people present, humidity will rise and disease germs thrive, multiplying more rapidly than in dry air. These germs may even attach themselves to the walls and furnishings of the space, propagating under favorable conditions which develop.

Large industrial plants having low ceilings and large numbers of persons working close together, are subject to these same factors. High ceilings eliminate a portion of these unhealthful conditions. The use of open flames for heating and burning frequently permits the escape of poisonous gases which contaminate the air, thus creating a hazard.

In years past, the old stove in the center of the industrial plant furnished the heat and also served as a germ killer, although even temperature in the space was unknown. Under these conditions less disease was apparent, the heat of the stove (300 to 500 degrees) sterilizing the air which came in contact with it. Colds and nasal disorders were less frequent because of this sterilization process. The comfort of employees working at some distance from the centrally located stove, however, was not so good, but the air was reasonably fresh, owing to the fact that the air, admitted through the door and window cracks, was fresh. In our modern industrial plants, we strive for even temperatures, and neglect, in many cases, the quality of the air.

A few years ago an engineer presented to the writer, a sketch of a house heating plan, calling for recirculation of air for heating. After some discussion this plan was discarded and a complete outside air layout was presented to him, with the thought that 10 per cent advance in operating costs would be satisfactory for heating fresh, vital air and avoiding drafts, and cold stairs and floors. The installation was completed according to the outside air layout for ventilation, and the results were fresh and warm air, no floor drafts or cold floors, and a heating cost 30 per cent less than that of the preceding year which was a milder season. In the operation of this installation no exhausts were used; the fan, being of the pressure type, caused the air in the home to be released through the door and window cracks. When the east wind blew, the east rooms were just as warm as the balance of the house, and it was observed that the family was practically free from colds and kindred ailments.

The writer firmly believes that fresh air, properly handled to eliminate drafts, will help to produce healthier bodies and clearer minds than those produced in recirculated air. To substantiate this belief, many young people "walk around the block" to get their minds better fitted to do their studying or other mental tasks at hand. Fresh, invigorating air produces a keener mental attitude.

Use of a proper design for heating fresh, vital air may result in an increased cost of operation, but in many cases the cost will be less. Even if the cost of operation is more or less, the efficiency of the people who live or work in the properly ventilated spaces will be increased and their morale will take a decided turn for the better. Equipment may be more simple and the ducts smaller with higher velocities, and with register velocities cut to meet the conditions of the spaces ventilated. All used air should be exhausted to the open atmosphere and not returned to the conditioning system. Fresh, vital air absorbs heat better than does foul air. Fresh air will cool more satisfactorily and requires the addition of less moisture to bring the humidity of the ventilated space to the percentage required for comfort.

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Hay Drying

By E. E. WALKER
B. C. Electric Railway Co.

A NEW development in the use of electricity on the farm that is proving of particular interest to us at the present time is the use of electricity and coke in the drying of young green grasses. The attempt to use home grown feeds as much as possible in the feeding of livestock and poultry has led in Great Britain to the development of a machine that can be used in conjunction with the usual farm practice on the average small farm, that will produce a high protein product so that as little as possible of supplementary protein rich feeds will need to be purchased.

A parallel to this development in Great Britain has been the invention and perfection of large scale equipment in the United States. These are of two types: the one based on experiments carried out at the Louisiana State Agricultural College, which employs a rotating drum; and the other type employed by the Fulmer and Randolph Grass Dryers, having an endless chain conveyor on which a moving mattress of grasses is subject to hot blasts of air. These types of machines, which have in many cases in the United States met with considerable success appear to take a large amount of capital and a large acreage to support them.

These large driers are in the hands of specialists who are making high protein dried feeds mostly in irrigated alfalfa districts. We have found on investigation and in conversation with farmers and superintendents of experimental farms that the smaller English type is best adapted for our particular conditions and I believe that it would also suit conditions in the Northwest states. It has a rather small capacity, producing one ton of dried grass per day. In our delta districts where green grass grows rapidly and abundantly for a period of about one hundred and twenty-five days, it would require about thirty acres to support one of these machines and approximately one hundred and twenty tons of dried grasses with a content of 16 to 20 per cent can be manufactured.

This machine landed on our seaboard costs $1,500. By the time it is set up on a farm, with motor and other incidental equipment we estimate the cost will be $2,000. It employs a 7½-hp. motor and uses coke as a source of heat, requiring half a ton for each ton of dried grass produced. All the hot gases of combustion are drawn from the furnace through an 8-ft. rotating drum. The wet grasses are mixed with the hot air and gas as it enters the drum and is expelled in the separator beyond the fanning unit. As yet there are none of these machines in our territory, but we expect that one of our Experimental Farms will import one. We intend, for our part to co-operate by supplying electricity and coke for an experimental period.

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Electricity in The Plant Nursery

By U. K. PETERSEN
Northwestern Electric Co.

THE Sherwood Nursery of Portland, Oregon, started on a small scale two years ago and now has twenty times the original area devoted to electric soil heating for plant propagation. They have developed many new varieties of trees and shrubs that have been shipped to the East and to Holland. Many of these have never before been propagated in a commercial way, although repeated attempts have been made.

With electric soil heating there is a lack of plant disease and nematode present, owing to the favorable conditions which are developed, such as uniform ground heat, proper humidity,

air circulation, ease of watering, and control of space temperature. The growing and rooting time has been cut considerably, and the trees and shrubs are healthy and strong with large roots, and ready for the market within a few weeks after planting and application of electricity to the soil cable.

The Sherwood greenhouse is constructed of concrete, with steel sash frame. The propagation area of 2,400 sq. ft. is apportioned into beds of 36 sq. ft., each bed having 400 watts of electric heating cable. There is a disconnect switch on each bed so shrubs can be removed or planted, or for use when heat is not necessary for rooting or growing. Several sections are connected to one thermostat to insure a temperature of from 60 to 75 degrees, depending upon the type of shrubs or trees planted. The entire greenhouse heating and air circulation is automatic and requires no care or adjustment during propagation period. Watering is done by hand so plant inspection can be carried on at the same time.

Planting of 500,000 trees and shrubs was started on Aug. 1, 1937, and by Jan. 29, 1938, 900,000 trees and shrubs had been rooted. A new crop of 500,000 plants is now being placed in the beds for rooting.

The kw.-hr. consumption from Aug. 1, 1937, to Jan. 29, 1938, was 38,312, or an average of .043 kw.-hr. for rooting each plant, bringing the average cost to 43c per thousand plants. Electric soil heating increases the capacity of the greenhouse and produces growing plants for market many weeks prior to the usual propagation method, and the plants have stronger stems and larger roots.

A conference of greenhouse operators, frame operators and plant growers was held at Oregon State College, in November, 1937. Considerable time was devoted to discussion of tomatoes and soil composts. Prof. A. G. Bouquet discussed several ways in which heat and humidity affected growth of healthy plants and fruit.

Pollination of flowers is best after six hours at 70 to 85 deg.

Light plays an important part in plant efficiency, as indicated in Table I.

Excess heat causes pistils to grow, and long pistils do not pollinate so well as short pistils. Experimentation shows results as in Table II.

High humidity makes fruit set better, but encourages the growth of mould pest.

On hot days water is pulled out of the leaves and the pull is heavy, also, on the fruit. From one to one and a half hours are required for the water in the fruit to start going out of the leaves, and four to eight hours for the water to return to the fruit or stem. At a temperature of 85 deg., a great deal of water is given up by the fruit, and watering the plant will not stop the fruit water from going out the leaves. By reducing the temperature to 80 deg., the fruit will be improved.

Soil sterilization, to rid the soil of nematodes and pests, was considered at some length. Experience has shown that electric soil sterilizers produce the best results in the shortest possible time. Current consumed in small sterilizers was 30 amp. at 110 volts in boxes 18x18x6 in. and 60 amp. at 220 volts in boxes 18x18x12 in. The time consumed in either box was from 3 to 30 min.; 150 deg. was hot enough, as too much heat would kill the bacteria.

Temperature of a greenhouse may be maintained as desired, with one degree variation between the floor and ceiling, by forcing, under pressure, the heated or cooled and filtered fresh air into the greenhouse. Humidity could be added or removed as needed. The air under pressure would stop drafts which do have their effect on growing plants.

The above statements show that the electrical industry can, by means of automatic soil heating, soil sterilization, air circulation, and humidity control, play an important part in helping the farmers produce better plants, shrubs and fruits. Automatic control is the only sure way of securing the desired results.

Greenhouses should be made as tight as possible and when the proper soil is in place, the space should be kept at a temperature, humidity, and pressure best suited to the growing products.

Fresh air should be taken from a place that is as nearly even tempered as possible, filtered, then heated or cooled, humidified and forced into the greenhouse, and allowed to leak out the best way it can. This system, under automatic control, would prevent insects entering the greenhouse and would help keep out disease germs.

Light should be controlled during the growing and fruiting period, and this can be accomplished by the use of electric lights having reflectors placed at the proper height to give suitable intensities on the benches. The electric eye could be used to control the light volume.

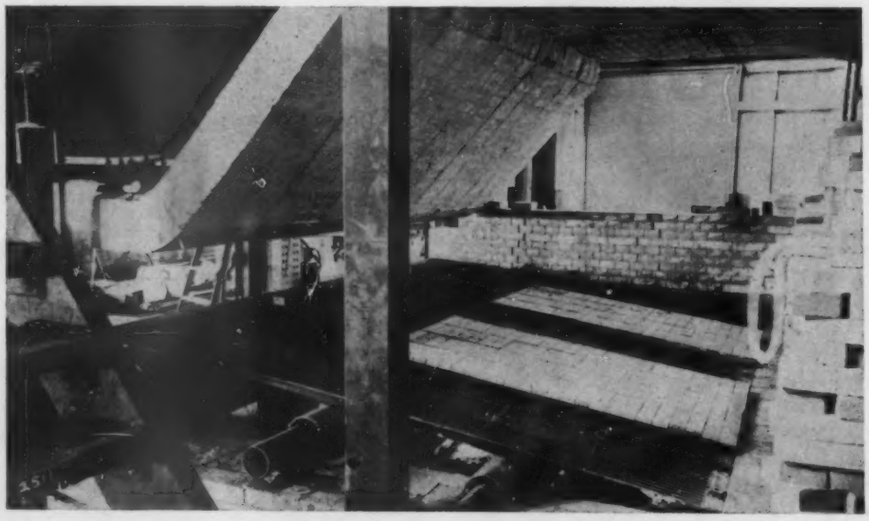
New methods of soil sterilization, which will accomplish more work in a given length of time, can be developed.

Table I

Footcandles	Leaf Area	No. of Fruits	Fruits Per Plant
1139.9	7288	271	22.5
583.1	3894	205	17.0
261.0	2229	142	11.8

Table II

At 100 degrees temperature— 6.3% pollinate after 42 hours
At 85 degrees temperature—66.0% pollinate after 50 hours
At 50 degrees temperature—21.5% pollinate after 60 hours



Power Production Committee*

Dutch Oven for Hogged Fuel

By J. H. SIEGFRIED
Pacific P. & L. Co.

MUCH has been written about the use of waste wood for fuel. This waste comes in the form of shavings, sawdust and all waste lumber which has been run through a machine, known as a "hog", which cuts it up or rends it to pieces in sizes which can be handled readily. This waste wood, when properly burned in properly designed furnaces, forms a very useful by-product.

This fuel has characteristics which must be considered when designing furnaces for its combustion. The characteristics vary with different kinds of fuel and types of wood. In this paper, I shall confine my remarks to Douglas fir as is available from mills in northwestern Oregon. The proximate analysis of such hogged fuel is shown in Table I.

Table I

Condition	As Fired	Dry
Moisture	49.83%	0
Volatile Matter	40.96	81.64
Fixed Carbon	8.83	17.60
Ash	0.38	0.76
Total	100.00	100.00
B.t.u. per pound	4485	8939

This table shows that practically half of the fuel, by weight, consists of water which must be driven off and superheated to the temperature of the stack gases. Practically 41 per cent is volatile matter, so that this fuel, although it is a solid, must actually be treated and burned as a gas.

This fuel burns on the surface and the furnace design must be such that this action will be continuous. Sawdust piles have been ignited and the fire spread rapidly over the entire surface, but after the surface has been completely burned over, the fire went out. This fuel requires more air for combustion than either coal or oil and yet the use of forced draft must be very limited.

It is necessary that if the size of the furnace is to be kept within reasonable limits, the combustion of the hogged fuel must be rapid to deliver the amount of heat required in a given boiler.

It has the disadvantage of being very bulky. By volume, a cubic foot of a good grade of bituminous coal contains ten times as much available heat as a cubic foot of hogged fuel.

It has the disadvantage of requiring great storage space for an adequate supply and this storage must be used within a limited time, otherwise the fuel loses some of its heat value. At one time, when the mills were not operating and no hogged fuel was being manufactured, I had analyzed a sample taken from a sawdust pile which had been exposed to the elements for a long period. The analysis indicated a moisture content of 63.8%, 1.4% ash, heat available as fired 3,196 B.t.u., while the total heat of the dry wood was 8,830 B.t.u.

Some years ago, the company with which I am connected, built a steam plant in Oregon near the mouth of the Columbia River. The boiler plant consisted of three 600-hp. Sterling boilers and originally the plant was used only for stand-by service and oil was used for fuel. Later it was necessary to carry all the load at this plant and dutch ovens were installed for the consumption of hogged fuel and were located at the end of the boiler opposite the oil furnace.

These ovens were equipped with ordinary cast iron grates, with an area of 12 x 12 ft. The arch consisted of Deitrich tile supported on iron hangers. The bridge wall was offset approximately 12 in. from the center line of the nose of the arch. Fuel was introduced to the furnace through four holes, in the top of the furnace, spaced 6 ft. apart across the furnace and four ft. apart in the opposite direction. The entire furnace was 17 ft. 10 in. long. These dutch ovens were built in 1923.

In 1936, it was decided to rebuild the dutch oven for one boiler, and, after thorough study, a different type of furnace was built. In the newer type, the furnace is only 11½ ft. long and the total available grate surface is 9 x 12 ft. This is 75 per cent of the space occupied by the old grates, but the new grates furnish a free air passage of approximately 45 per cent the total grate surface, compared with 20 per cent for the cast iron grates. These water cooled grates were arranged in the form of a capital letter E, the open end being next to the bridge wall. Between the arms of the letter E, the space was blanked off with brick to form a hearth which further reduced the grate area by an amount of 35 sq. ft. These dead spaces were located under the thickest part of the fuel pile. This arrangement reduced the cost of the grates for this boiler.

Instead of building the flat arch the full length of the furnace, it was built half the length from the nose and at that point, a sloping wall at an angle of 45 deg. was carried down to the furnace doors. The fuel being fed in at the top, the sloping sides would ordinarily form a pile making an angle of 45 deg. with the horizontal and the sloping wall is therefore parallel to the surface of the fuel pile. This construction was decided upon to reflect the heat from the tile against the fuel pile and cause ignition to take place more readily. The bridge wall was moved back from the nose of the furnace, a distance of 3½ ft. compared with 1 ft. in the old furnaces. This was done to create as much turbulence in the air and gas given off by the fuel to give a better mixture and cause the combustion to take place in the combustion chamber.

The arch is supported by steel work carried on the main columns of the building so that there will be no op-

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portunity for the dutch oven to move away from the boiler front as we experienced in the old design. In the old design, the ash pits were filled with water and the ashes and unburned fuel which dropped through the grates were flushed away by a heavy stream of water. The new furnace was arranged to operate with a dry ash pit allowing any unburned fuel which fell through the grates to burn in the ash pit and assist in raising the temperature of the air under the grates. The furnace doors are of the curtain type working vertically and are constructed of insulating firebrick. These fire doors are so arranged that the entire grate surface is accessible for cleaning. An overdraft damper was installed in the ash pit at the outer end of the grates. This was installed to allow more air to pass over the fuel pile than would ordinarily be the case. These dampers were supported on the front header of the water-cooled grates and are operated from the firing platform.

Results

This design has resulted in:

1. Considerable saving in the amount of refractory material used because of the reduction in length of the furnace and the sloping half of the flat arch.
2. The design has resulted in lower temperature in the furnace than in the old type and raised the temperature in the combustion chamber, allowing cheap brick to be used.
3. The water cooled grates return approximately 20,000 B.t.u. per sq. ft. per hr. to the feedwater system.
4. The elimination of the water in the ash pit has resulted in a slight increase in temperature of the air passing through the grates and there is no moisture from the ash pits through the fuel bed to be raised to stack temperature.
5. The water cooled grates prevent clinkers from sticking to the grates so that the cleaning process can be done quickly and without cooling the furnaces to any great extent.

At no time, has there been any trouble with overheating in the ash pit due to fire falling through the grates. After small amounts accumulate, the live fire seems to burn out without any undue heating effects, and reduces the amount of material to a small volume and we find it necessary to clean the ash pits only at long intervals, usually of about three weeks. In the old furnaces, it was necessary to clean them daily and we found it more satisfactory to flush them out once each shift because of the difficulties in removing large accumulations.

Recently, we made certain experiments with forced draft in connection with this furnace. We found that with natural draft and firing under normal conditions with 1 3/16 in. of negative pressure at the stack damper, we were able to obtain an evaporation of 29,000 lb. of steam per hr. The draft in the furnace at the bridge wall varied from ½ to ⅝ in. With a forced draft and a positive pressure of ⅝ in., under the grate, a negative pressure of ⅛ to 3/16 in. in the furnace at the bridge wall, and a negative pressure of 3/16 in. at the stack damper, we were able to obtain an average evaporation of 36,000 lb. per hr. over a period of several hours. The maximum on several occasions reached 40,000 lb.

Under these conditions of forced draft, a large amount of light material was carried over the bridge wall and into the oil furnace. This caused considerable trouble with slagging in the oil furnace even when oil was not used. It is possible that a higher bridge wall might eliminate this.

This furnace is apparently too small for the boiler and does not have the capacity of the old furnace. The sloping arch at the front is a decided improvement but the dead space in the grates is not. This allowed fuel to accumulate between the fuel inlet and the bridge wall to too great a depth and it would fall into the oil furnace. This was remedied by replacing the firebrick next to the bridge wall with cast iron grate bars and sufficient air now passes through to keep the pile burned down to a reasonable thickness and exposes a portion of the bridge wall which, when heated, radiates heat to that side of the fuel pile and assists in ignition.

It is necessary that the other two furnaces be rebuilt in the near future and consideration is being given to a new design. This calls for a furnace with the same overall dimensions as the original type and will be arranged for forced draft operation. The sloping front wall feature will be used and the entire grate area will be used for grates. Some of the center section may be of the cast iron variety and the remainder be water cooled. Vertical doors will be supplied and the relative position of the nose and bridge wall as used in the first rebuild, will be retained.

The reasons for this decision are that the design allows the use of all the present steel work, tile hanger supports, feeding equipment, etc. an enlarged furnace, and the use of forced draft during time of heavy demands.

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Discussion

By O. D. LANNING
Eastern Oregon L. & P. Co.

AN outstanding improvement in the furnace described would seem to be the use of the sloping wall to increase the heat reflected upon the fuel pile.

In Eastern Oregon, a considerable part of the refuse fuel from the lumber mills is comprised of shavings. These shavings present a considerably different problem in combustion than that for hogged fuel. The heating value of fresh planer chips, as received, shows 8,450 B.t.u. per lb. with only 12.8 per cent moisture content.

We have a peculiar problem in one of our boiler furnaces. Under loadings of 130 per cent to 150 per cent and over, there occurs a sort of resonance condition between draft and combustion which results in puffing that reaches hazardous proportions. Unless the factors of draft, space, and combustion are carefully considered in design such a condition will surely develop in other furnaces. We have eliminated the action to a considerable degree by opening the lower clean-out doors to the combustion chamber, and operating with them open. This is, of course, not desirable.

With respect to hogged fuel, we have submitted samples of such fuel from Ponderosa Pine to the Oregon State Agricultural College, and their reports compare closely (although indicating a somewhat better heat value per pound) with the report of Siegfried for Douglas Fir. Our report shows 5,095 B.t.u. with moisture 48 per cent. We have found, however, that in our dry climate, if hogged fuel is stored carefully so it is not subjected to a "sweating" or distilling action, samples from fuel stored 18 months showed 7,340 B.t.u. with moisture content reduced to 19.34 per cent. The heating value, on a dry basis, dropped from 9,800 B.t.u. to 9,090 B.t.u. per lb., or only about 7 per cent.

O. L. LeFever: When piled in large piles, hogged fuel heats up and the volatiles are driven off. You have to keep it moist to keep down this heating process, and then when you burn it, you have to drive this moisture off with radiant heat. You need a large secondary combustion chamber to get enough space for burning the volatiles before they hit the tube. In this way you get more value out of the volatiles.

H. A. Patton: There is a hazard from dust in storing and burning hogged fuel. You should give attention to the superstructures where dust may accumulate.

Walter Brenton: It is possible to construct higher efficiency furnaces, but the costs amount rapidly. Efficiency is brought about by higher temperatures, pre-heated air and water cooled grates. Water cooled grates, however, are frequently justified on the basis of economy and maintenance.

It is important to have radiant heat to assist in combustion. This is obtained by having heavy refractories to absorb the heat and refract into the combustion chamber. If you feed from the bottom of the conveyor, with the chutes closed, you get rid of most of the dust hazard.

Water Wall Repair and Maintenance

By A. L. POLLARD
Puget Sound P. & L. Co.

IN September 1929, two 2,500-hp., 450-lb. pressure, Sterling-type boilers, equipped with forced and induced draft fans, and partial water walls were put into service at Puget Sound P. & L. Co.'s Shuffleton Power Plant. Purpose of partial water walls was to permit installation of front and rear Dutch ovens for hogged fuel, should operation with this fuel become feasible in the future.

Sixteen horizontal, turbulent-type fuel-oil burners were installed. Water walls on the sides and rear were protected by refractory-faced cast-iron blocks, while the front wall was protected by a bulb-type tile, fitting between the tubes from the fire side, and leaving the center of the tube exposed. Early in 1930, a third boiler of the same size and general characteristics, built by the Puget Sound Machinery Depot, was put into service. These boilers were designed for a maximum output of 330,000 lb. per hr., or 400 per cent of rating.

During inspection, after the winter run of 1936, it was found that the refractory on the rear water wall blocks of No. 1 and No. 2 furnaces had been almost completely burned off and that the exposed cast iron had melted and run over the brick furnace lining below, causing the brick to fuse and melt. The rear brick wall was approximately 12 ft. high, and a result of the cast iron causing the brick to fuse, looked like snow when hot water is thrown on it. The side water-wall blocks were still in fair shape and would probably last one or two seasons more. The rear wall of No. 3 furnace, which had not had as much or as severe service as No. 1 and No. 2 was still good for another year.

The question then arose as to how to repair the rear water wall: whether to renew the refractory-faced cast-iron blocks or to use some other type of wall. Decision was to install a suspended, Shadow-type tile wall in place of the cast-iron blocks on the rear wall of No. 1 and No. 2 furnaces. Furthermore, the furnace floor was raised about 7 ft. to minimize furnace maintenance, by reducing the exposed brick lining about 3,654 sq. ft. This change eliminated the possibility of using hogged fuel but left sufficient furnace volume for proper combustion of fuel oil at 400 per cent rating.

With this type of wall, it was necessary to make a new base for the mud-drum protection wall. This had previously been supported on top of the refractory-faced blocks, which were cast to take care of the curvature of the tubes. A base for the mud-drum protection wall was provided by welding suitable plates directly to the upper portion of the water-wall tubes. To protect the plates, chrome plastic was pounded around them and between the water wall tubes so that the plates were protected on all sides by at least ½ in. of plastic. This work was completed in the fall of 1937. One winter's operation indicates long life and low maintenance.

A chrome wash has been applied to the remainder of the blocks and has been found to adhere strongly and to stand up well under the intense heat. A good protective coating is being built up which will, it is hoped, extend the life of water wall blocks considerably. The chrome wash must not be put on more than 3/16-in. thick, as it then tends to peel and drop off. Best results have been obtained by putting the chrome on while the walls are warm and then, after a few hours of air drying, to fire the boiler up.

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Wood Stave Pipe Replacement

By O. D. LANNING
Eastern Oregon L. & P. Co.

THE pipe line we are to consider was constructed in 1906. It serves Fremont Power Plant (now the property of Eastern Oregon Light & Power Co.), located in the Blue Mountains, 35 mi. west of Baker.

The water shed for this plant is 9 sq. mi. at elevations between 6,000 and 8,000 ft. Two artificial lakes created by means of dams, make it possible to impound 6,300 acre-ft.

Water was conveyed to the plant by means of 28,400 ft. of wood-stave pipe, varying in diameter between 23½ and 33½ in. and 2,600 ft. of 20-in. lap-welded steel penstock, all constructed through exceedingly rough country. The head under which this water is supplied is 1,067 ft. In the plant are two 550-kw. generators, direct connected to Pelton Water Wheels. Maximum head on the 23½-in. wood-stave pipe is most unusual—430 ft.

From 1906 to 1921, little pipe line trouble was experienced, but during 1921 and 1922 trouble did develop (including two bad breaks, one in the high-pressure section) which gave rise to consideration of a replacement program. During the following ten years the operators gained great experience in the art of patching and plugging, and installing additional bands and shoes.

In 1932, the pipe line being 26 years old, with conditions being propitious for engineers to study and do little else, a detailed analysis was made of the economic value of Fremont Plant, pipe line and transmission line.

The object was to determine whether or not complete abandonment was indicated, and if not, what was the justifiable annual expenditure in maintenance and improvements, based upon the equivalent power from other sources then available. Conclusions justified the company in spending a considerable sum each year to continue operation of this plant.

By the spring of 1937, conditions were such that replacement of 500 to 1,000 ft. was imperative.

Following decision to replace 3,000 ft. of pipe, price quotations for untreated and creosote treated fir staves were taken. There showed that for an increased material cost of about 13 per cent, useful life might be increased from 50 to 100 per cent. The decision to use treated pipe naturally followed. Staves were available in thicknesses of 1⅜, 1½ or 1⅝ in. Since each ⅛ in. increased the material cost by only 3 per cent, decision was made to use staves 1⅝ in. thick from material 6 in. in width, thereby gaining full benefit from material and the least number of longitudinal seams. The diameter of the existing 33½-in. pipe was considered and found to be adequate. However, friction losses, pipe line profile and hydraulic gradient were reviewed before deciding to use 34-in. diameter, nearest standard the old size.

The question of the type of butt joint most suitable was studied. Staves in the old line had been jointed at the ends by means of metal tongues. Inspection clearly showed that freezing of moisture between the ends of the staves outside the metal tongue had caused a splitting and lifting action. There are two types of butt joints now manufactured which provide a protecting shield both inside and outside, over the end of each stave, as well as an inner spline or tongue. One such joint requires that the ends of each stave be specially milled and permits positive treatment of the wood at the point of insertion of the inner spline, but has a possible disadvantage in presenting more exacting assembly problems. A second type relies upon a sharper middle spline to provide a seat by a splitting action, thereby requiring less special milling and possibly presenting less precision in assembly. Decision in favor of the latter joint was made largely because of a much better delivery date.

Another decision concerned the depth to which the new pipe should be covered. With treated pipe the manufacturers told us that no difference in life

would result whether covered or partially covered. In general, where rock and soil conditions readily permitted trenching or where the hydraulic gradient had made trenching necessary the old line had been covered. More or less arbitrarily we decided upon coverage to one half the diameter as being ample to cradle the pipe and hold it from moving with changing water velocities.

Three separate contracts covered purchase, hauling and installation. The manufacturing companies submitted alternate bids on delivery of pipe in Baker, and bids on pipe installed. However, the installed bids were based upon previous removal of old pipe and preparation of trench by the company. Since the job was 60 mi. by road from Baker, a construction camp was a necessity. The plan of the manufacturer was to send to Baker an expert pipe foreman who would secure his crew locally, establish and operate his own camp and install the pipe. Obviously before this time another crew and camp would have been required to remove the old pipe and prepare the trench. Under these conditions we decided the best course was to let one local contractor handle the entire job of removing the old pipe, piling the staves, trenching, constructing and backfilling with the particular understanding that he would secure the services of an expert pipe foreman from the manufacturer. A job of this kind had never before been attempted by the local contractors. Arrangements for hauling the material from the Freight Depot in Baker to the contractor's yards in the mountains were made with a local bonded and licensed trucking firm. Fortunately no strikes interfered with delivery, the trucking firm secured outside assistance as needed to handle the shipments without demurrage, and the pipe foreman was available on schedule.

From this experience I would, however, definitely recommend that where an arrangement can possibly be worked out the job may best be done under one contract, either with the manufacturer or the installing contractor.

Part of the job was replacing 1,330 ft. of branch pipe line. The contractor elected to replace this first. Drainage of this branch and 5,500 ft. of mainline from junction to the dam was necessary because the junction was not equipped with valves. Following drainage, a plug was installed in the branch at the junction and the main line refilled permitting plant operation to resume.

Great care was needed in draining this old pipe because it had not been drained in almost five years. All of the air-vacuum breather valves at the summits of the vertical curves were tried out before starting to drain.

At the low point in the branch line the drainage was to have been judiciously hastened by the simple process of knocking a hole in a stave with a sledge. However, the operator of the sledge had waited years for this event and in a burst of enthusiasm quickly added two more holes. The action which followed was grand to see, but when we crossed a small rise in the branch line on which the original builders had not placed a breather valve, we found a section had quietly folded inward. Fortunately the breathers along the main line had been properly located and functioned.

The crew made short work of wrecking the branch line and making piles of the old staves about 100 feet apart for drying and future burning. Steel bands and shoes were buried. The old trench was then excavated to the proper width and depth, and minor changes were made in alignment and grade as specified in the contract. A trench having a depth about equal, or only a few inches greater than the outside diameter of the pipe, should be at least 2 ft. wider than this diameter. Insufficient trench width greatly increases the work of constructing the new pipe, particularly the banding operation. While the trenching work was going on, part of the men were distributing the new staves, bands, and shoes in piles along the trench. Each pile contained the 21 staves required for a section, selected from the yard so that the maximum difference in length was 18 in. The staves had a bead along one edge and a groove on the other. This feature makes necessary care in having each stave hold the same relative position of bead and groove as that established for the first circle or section. Failure to attend to this little detail may cause wasted time and effort turning staves end for end while a crew waits. Where butt joints of the type in this job are installed, some contracts call for a mark on the end of each stave on the outside to which the joints shall be driven. Such marks clearly show failure to drive tightly. Our contract did not include this point but by closely watching the driving-up process we secured a satisfactory job.

The pipe foreman sent by the manufacturer arrived as scheduled. Two or three days is required by even an expert to find which men available are best fitted for the various places on the building crew, and to develop a smoothly working group. In such a crew, one man is required to wield the driving sledge, one man to hand staves into the trench, two men on each side of the pipe forms in the trench, one man inside the pipe to check inside and outside forms, joints, etc., two men following up with bands, and two utility men keeping the trench in condition, bringing up extras, placing bands and shoes, installing air-vacuum valves and drainage valves or tightening and retightening bands. Such a crew under average conditions will install about 200 ft. of 34-in. pipe in eight hours. Under pressure the output may be raised to 250 ft. and under exceptionally good circumstances, possibly 300 ft. As a figure to have in mind for estimating purposes, it is safe to assume 200 ft. of 34-in. pipe per 10-man crew, working 8 hours per day. This does not include distributing material, trenching or backfilling.

The tightening, and retightening of the bands where needed is important, and the engineer following the work will need to acquaint himself with the "feel" of a wrench on a properly tightened nut, and the appearance of a correctly installed band and shoe. There have not yet been devised instruments or tools which will take the place of trained hands.

Finally came the task of refilling the new and old pipe. Here again great care was necessary to prevent undue strain on the remaining old pipe. All air relief valves were individually tested to make sure that no air pockets remained. During the first hour or two the newly installed pipe leaked like a sieve, a fact which to the uninitiated was most discouraging. However, after six or seven hours the staves swelled enough to take up most of the leaks. A few bands required retightening particularly at valve saddles, but in four or five days one had to look closely to discover leakage. Tests made by weighing samples of wood staves show that the period of expansion through absorption by water is in the order of 50 days. Creosoted staves expand less rapidly and to a lesser degree.

Of particular interest to us, and also to other engineers in our district, was the condition of the old 1906 staves. Many of them showed unbelievably little sign of age, but others were almost paper thin in spots. I have discussed this subject with the forest supervisor of the Whitman National Forest and others. There are sound reasons for the belief that those staves which are in good condition were taken from high grade heart-wood stock, whereas those which have not withstood the test of 31 years in service, were largely made of sap-wood, or stock from outer layers of logs. There is no doubt but that careful inspection and rigid specifications are justified wherever untreated staves will be used. If such care is taken by the purchaser, he may then turn to the history of the Fremont Pipe Line to give him faith that from such material can be built a pipe which will live for 30 years.

Interconnection Control Problems

By M. L. BLAIR
Washington Water Power Co.

IN THE Pacific Northwest interconnection of power companies to form one large system has aggravated many problems, some old, some new. In the attempt to use interconnecting ties to maximum capacity without undue disturbance to the customers of the many systems, heavy swings on the interconnecting ties and poor speed regulation have become problems of prime concern. This paper is on that portion of the problem which concerns the coordination of the governors and controllers of the several systems. In the discussion of this problem, the writer has borrowed freely of all data available to him, and is indebted to the operators and engineers of the various systems for the success and data of the numerous tests.

It has been normal for Pacific Power and Light, Washington Water Power, and Puget Sound Power and Light to run in parallel. City of Seattle Light Division, which can tie to Tacoma Light, can now tie to the Puget Sound and is operating in parallel on occasion with the previously mentioned group. Portland General Electric and Northwestern Electric are interconnected whenever there is occasion. Last summer five of the major companies were in parallel: Puget Sound, Northwestern, P.P.L., Montana and W.W.P. These companies cover a 300x900-mi. area. In addition, others, such as Mountain States Power, Washington Gas and Electric and Grays Harbor Railway and Light, can operate in parallel with some one of the five.

The tie from Camas through Condit to Union Gap, between Northwestern and P.P.L., has a low capacity in relation to that of the enlarged system. The same has been true of the tie between Montana and W.W.P. The ties between the W.W.P. and P.P.L., and between W.W.P. and Puget Sound are comparatively heavy, but have at times been used to their maximum extent.

As the systems were interconnected, it was found that load swings on the transmission ties between systems became greater as more systems were added. With five systems interconnected as much as 20 per cent of the stable capacity of the tying line was lost in reduced loads to avoid separations. The load changes on the interconnecting ties appeared to conform rather closely to a uniform beat and sometimes exceeded 20,000 kw. Swings of such proportions reduce useful capacity of the lines. Even by further reducing the load, separations could not be entirely eliminated. Such separations always occurred at maximum relay settings, or at the limit of the steady state stability, with a considerable disturbance on the entire interconnected system. Another disturbing factor during heavy interchange was the swinging of voltage on the same beat as the load swings at points where transmission loading approached line stability.

The combined systems include heavy transient loads (like mine hoists, large dredges, and railroad electrifications), for which it is hard to regulate. The flywheel action of one system in relation to the other through a comparatively small tie undoubtedly has its effect. Installation of automatic controllers has definitely changed the character of the swings on the tie lines, and their lack of coordination in all probability is one of the causes. Inasmuch as the ties are not likely, for the present, to be strengthened and the type of load cannot be changed, a solution must be found in the governor and controller action.

The enlarged interconnected system has a variety of plants and types of governors. No two hydro plants have the same characteristics, and there are steam as well as hydro plants. Furthermore, engineers on each system have adjusted their governors to their own ideas and standards frequency. To this multiplicity of conditions have been added automatic-frequency and tie-line-load controllers.

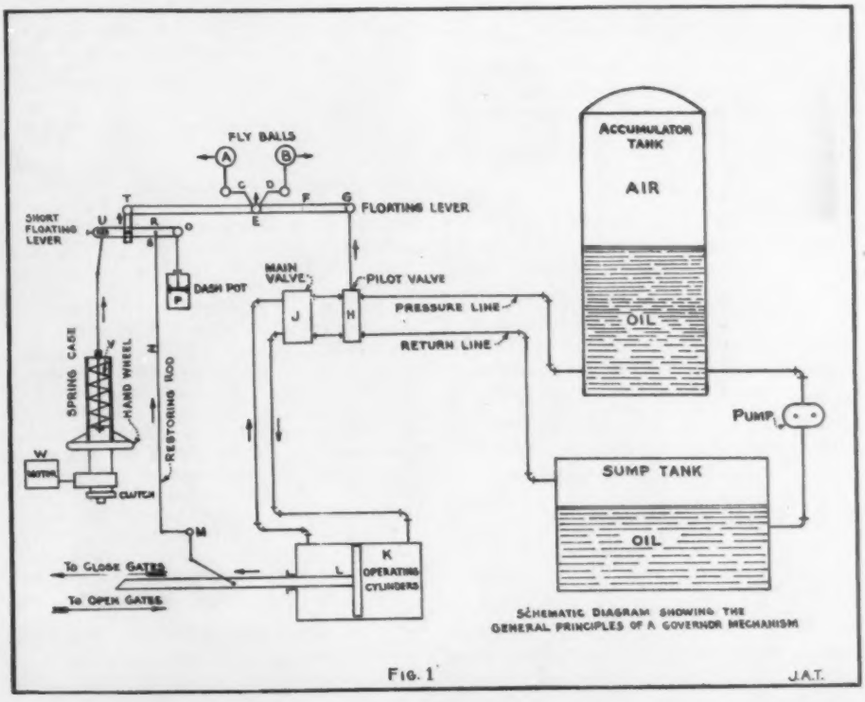
With the addition of automatic devices and the problem of holding systems together, the electrical and operating engineer have become involved in governor adjustment. It is a four way problem that can best be solved by the combined efforts of mechanical, hydraulic, steam, and electrical men. The governor is a mechanical device, but it controls the flow of water or steam, and vitally affects the operation of the electrical system.

The governor is essentially an automatic throttle which recognizes changes in speed and controls the flow of water to the prime mover by shifting the position of the wicket gates in relation to this change in frequency. Fig. 1 indicates the principal components in a governor. Though this diagram will not exactly match the several makes of governors, it does show the various principles involved in all makes.

Assuming a drop in load, the system frequently will rise causing the centrifugal fly balls A and B to move in the direction of the arrows. With the fixed points C and D this will raise point E on the floating lever. Point T on the floating lever is for the moment fixed and the raising of point E will raise G which is connected to the pilot valve H. The pilot valve operates the main relay valve which allows oil under pressure to flow from the accumulator tank to the operating cylinder (servo-motor). With pressure in chamber K of the operating cylinder, piston L will move to the left to close the gates. Point M is fixed, and any movement of the servo-motor to close the gates will raise the restoring rod N. The restoring rod is attached to the auxiliary or short floating lever R, the two ends of which are connected at Q to an adjustable dashpot and at U to a spring V. With the upward movement of the restoring rod the auxiliary lever is forced up. The dashpot P is for the moment essentially fixed and the movement of the auxiliary lever is around the point Q which distorts the spring V.

To repeat, a drop in system load will move the fly balls out, raise the floating lever, open the pilot valve, and continue to close the gates until the restoring rod has raised the floating lever to the neutral position of the pilot valve where the pressure line is cut

Fig. 1—General principles of governor mechanism



off. At this point in the series of mechanical movements the governor is balanced with the exception of the spring V which, in this example, is compressed. The operating cylinder and therefore the restoring rod are at rest, making S a fixed point. As the spring returns to normal it works against the restraining dashpot, but in so doing it raises the floating lever at T, again opening the pilot valve. This movement is repeated until all points are balanced and in actual service is a continuous process with the various movements overlapping to such extent that one cannot be recognized from another.

If there were no restoring action, the pilot valve would remain open until either the gates were closed or the drop in load by the generator had exceeded the original system load reduction; in which case the system speed would drop below normal and the fly balls would start another train of mechanical movements in the opposite direction. Without this restoring mechanism, a unit would constantly hunt with other units and with the load. The principal of a restoring mechanism is called *primary compensation.* In effect it gives to a governor an inherent drooping characteristic. That is, any governor which has responded to a change in speed will not return to exactly the original speed.

Speed droop is defined as the amount of drop in speed from no-load to full load expressed as a percentage of the normal speed. In other words, a unit running at 60 cycles with no load and with a 2% speed droop will lose 1.2 cycles in speed in picking up to full load. If there were only one unit on the system, the change of this unit from no-load to full load would drop the system speed from 60 cycles to 58.8 cycles. This is where the speed would stay if it were not corrected by the plant operator through control of the synchronizing motor indicated as W in Fig. 1.

The combination of dash pot, auxiliary lever, and spring is called the *secondary compensation.* It prevents hunting between units from overtravel, it allows an adjustment of the governor action on the gates, and is a function of system inertia, penstock length, and penstock water velocity.

Actually, many governors on a system have speed load droop. Only with this is it possible to operate units in parallel. Speed droop does not actually hold a unit in parallel with other units but determines the amount of load each unit will carry. Due to the electrical characteristics of an alternating current generator, it is held in synchronism with all the other units on the system. A change in load on the system will change the system speed, and the governors will correct this change in frequency in accordance with the governor characteristics. But before there is an appreciable change in system speed, there is an actual change in speed between the units and their load which the governors do not recognize. This difference in speed causes a change in output of the units in respect to each other and is supplied by the flywheel effect of the several units and the load center. This action causes a shift in the vector position of their respective voltages until a balance, determined by the electrical characteristics of the system, has been temporarily reached. The relative position of the phase angles again changes when the governors come into action. It is not generally believed that this difference in speed between units and load centers which is of such a transient nature can be detected by many of the present governors. However, it perhaps is a component of the resultant swings of the tie line loads.

Therefore, in respect to governor action, the instantaneous speed of all interconnected units can be regarded as the same under stable electrical conditions. The system frequency is then determined by the composite action of all units as predetermined by other factors, such as plant capacity and water supply. The speed droop of the governors is adjusted to give the desired division of load between units.

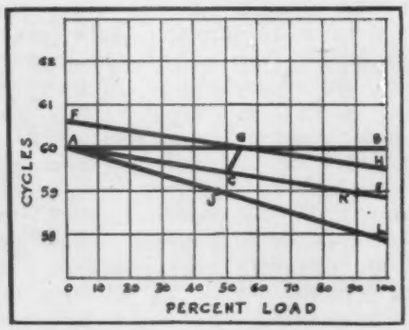


Fig. 2—Speed-load curves of a hydraulic governor

In Fig. 2, curve AGB shows a speed-load curve of a governor with a zero speed droop. Any change in the system frequency will cause a maximum movement of the gates. This will produce a unit which is unstable in respect to other units unless it is desired that this unit do all the speed regulation, and for a unit to be capable of such operation it must have a capacity larger than any possible change of load.

ACE is the curve of a governor with 2% droop in speed from zero load at 60 cycles to full load. When the operator notices the change in load and the drop in frequency, he corrects the speed by remotely controlling the synchronizing motor until the governor's speed droop characteristic curve has been raised to position FGH. The increase in load on the unit from C to G comes from an additional load demand with an increase in frequency from some types of loads.

Suppose we have two units operating in parallel at 60 cycles, zero load, one with a 2% speed droop ACE and the other with a 4% speed droop AJL. Assume there is a load increase on the system and the system frequency drops to 59 cycles both units AE and AL will pick up load; however, in inverse proportion to the respective speed droop characteristics of the two units. The load on AE will increase from A to K, while the load on AL will increase from A to J.

Another factor is the sensitivity of the governor, servo-motor, and gates. Sensitivity is the percent change in speed required to move the gates in response to this change in speed. Though sensitivity is expressed as a percent of normal speed, there is a time factor involved called dead time, and defined as the elapsed time between the initial change in frequency and the initial movement of the gate. Though sensitivity for any given governor is a fixed amount, the dead time will vary in proportion to the rate of change in frequency. The sensitivity of a governor will depend on a number of factors, such as play due to wear, inertia of parts, length of penstocks, volume and velocity of the water column, location of the surge tanks, if any, lap in the pilot and main valve, oil pressure, and length of the oil lines.

Fig. 3 is an illustration of what occurs in a governor ½ of 1% sensitivity. The cross hatched area indicates the sensitivity of the governor and gate mechanism of 3/10 of a cycle. Assuming the unit is carrying 50% load, then the shaded area EFGH is a dead spot as far as regulation by the governor is concerned. The speed can change from F to H and the load can change from E to H without any movement of the governor or the gates. The more sensitive the controlling mechanism, the closer the curve AB approaches DC and the points E and H approach F and G. Any governor appreciably insensitive may be a considerable factor in disturbing the system frequency due to false movements inside the area EFGH, and this is true especially if the speed drop characteristics are small.

The first attempt to improve the speed regulation and possibly improve interconnecting tie line control was the development of electrical devices to assist the governors. These are called frequency controllers and are essentially of two types: instantaneous, and time-error type. The instantaneous type corrects for any deviation from 60 cycles, while the time-error makes no effort to correct for instantaneous frequency changes, but holds the average frequency over a period by correcting for the difference between system time and standard time.

In the Northwest, the first frequency controller was installed in 1930 at W.W.P.'s Long Lake plant. This was followed by a similar installation at the Montana's Morony plant, and later by another at Northwestern's Ariel plant. The next move was the addition of a tie line load controller between the W.W.P. and Montana systems in 1936. Another tie line load controller of a different type has just been placed in operation between Puget Sound and W.W.P.

As far as the operation of the frequency controller is concerned, observations and conclusions are based mainly on the installation at Long Lake, which is now about eight years old, and, due to continuous operation, in need of a major overhaul. The Long Lake (and originally the Morony) fre-

quency controllers are of the instantaneous proportional step type with a flat characteristic (no speed droop). These can be adjusted to a sensitivity of 0.02 cycle. (Newer equipment has been developed which gives much greater sensitivity). Without question, installation of this controller at Long Lake improved frequency.

However, there was a change in the frequency band. Previous to installation, this band was narrow, but drifted according to the resultant effects of load changes, governor sensitivity and speed droop characteristics. With the frequency controller, and with adjustments of Long Lake governors to give a lesser speed droop in comparison to the other plants on the system, the average of the frequency band was right on 60 cycles. This band was approximately 0.2 cycle in width, with a beat of about 1 min. A beat of this magnitude had little effect on the other plants and it was felt that even with this constant changing of the frequency the quality of the speed control was much improved.

Concentration of speed control in one plant had the effect of requiring that plant to correct for all changes in load on the system. There were wide swings on the plant as it followed the constantly changing load. The effect of interconnection with other systems increased the load changes and at times Long Lake would drop and almost immediately pick up as much as 60,000 kw. on a 70,000-kw. plant. Such action has been severe on this plant. A change in load of this magnitude can arise from the simultaneous changing of loads on the several interconnected systems or from transfer of load from one plant to another plant on the same system, when improperly coordinated by system operators. Any change in system load or output of any prime mover will change system frequency and tie line loads.

The effect of this controller on interconnecting tie line control was not established, as no tests were made. One of the first tests was the attempt to control the tie line load between W.W.P. and Montana after installation of the frequency controller at Morony.

The controlling impulse originates from a contact making frequency element. This impulse is at intervals of 2 sec. and varies in length in proportion to the deviation of the frequency from 60 cycles. Through relays it automatically changes the settings of the governors by operating the synchronizing motors of each governor.

It might be well to emphasize the fact that the controller merely changed the governor setting and any effect the controller had on the movement of the gates was the final resultant of the new governor setting acting through the entire governor mechanism, including any biasing that might occur from the fly balls.

When the two systems were paralleled with both controllers in service the interconnected system frequency was the average of the basic settings of the two controllers. Even with adjustments on the controllers as fine as 0.02 cycle, there was a gradual shift in load from the plant with the lower setting to the plant with the higher setting. This shift was stopped only by manually changing the relation of the settings on the two controllers. No two controllers with the flat speed-load characteristics of these two devices can operate in parallel unless one or both is biased by the tie line load. However, there is an exception to this statement. With a decrease in the sensitivity of the two controllers the rate of drift will decrease to a point where only an occasional adjustment would have to be made. In all probability the reducing of the sensitivity would be done at the expense of the frequency.

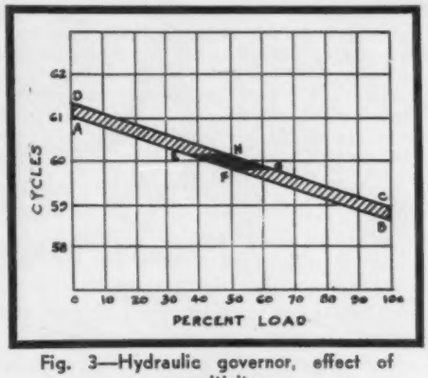


Fig. 3—Hydraulic governor, effect of sensitivity

After this attempt to parallel controllers the operating arrangement of the five interconnected systems consisted of the more centralized company controlling the frequency for the interconnected system, and the remaining companies manually controlling the load on the transmission ties. Even with almost constant telephone communication it was impossible to hold better than 50-per-cent capacity on some of the inter-system ties without numerous separations.

For some reason, not known at that time, the interconnecting ties would at times oscillate or hunt considerably. Addition of systems to the interconnection would amplify the beat but did not seem to change the period. However, it appeared that whenever one of the steam plants located on the coast would go into operation, the magnitude of this hunting would increase. As this hunting increased it became more difficult to interchange power between systems and there was a tendency for the frequency band to widen.

After considerable discussion and testing, a tie line load controller was installed between W.W.P. and Montana. This controller changes the load on Morony in relation to the phase angle existing between the East Side substation of W.W.P. and the Morony plant. Between the inter-connecting point at Burke, Idaho, and Morony is several hundreds of miles of transmission line. This line was of limited capacity and was supplying a territory load which has a maximum variation of about 15,000 kw. The interchange power was an added burden. It appeared, under this condition, that the greatest flow of power through the interconnection would be obtained by measuring the phase angle between the two points on the system rather than holding a fixed load at the inter-connection. By holding a fixed angle between two points, the load would vary through the interconnection at the maximum stable condition of the intervening lines.

A short synopsis of the action of the controller will be explained here. At the transmitting end, at Spokane, a carrier system on the 110,000-volt transmission was installed. The carrier was modulated by the sine wave voltage of the transmission system at East Side. This signal was picked up by a receiver at Morony which compared the received voltage wave to the transmission voltage wave at Morony and measured the phase angle difference. When this difference varied from a pre-determined setting, impulses were sent to the synchronizing motor of the units at Morony. Here again the limitation as to sensitivity and to speed of response was limited by the governor mechanism.

This tie line controller again changed the results on all interconnecting ties. The Washington-Montana tie held much closer to an average given amount. The variation from this set amount was only the changing of the intervening loads which thereby changed the phase angle. The width of the band was wider. The beat was approximately the same (as near as could be determined, 45 sec.) but the magnitude increased to where the swing occasionally was 20,000 kw.

The peculiar part was the oscillations or hunting on the tie lines to P.P.L., Northwestern, and Puget Sound Power. These showed the same per-cent increase in magnitude as the Montana tie, and were of almost the same form. These two ties were still under manual control but the hunting was becoming more severe. Some change in the control system at Morony and a readjustment of the frequency controller at Long Lake bettered conditions somewhat. These heavy swings were nullifying to a great extent the usefulness of the controllers.

A simple test was made in July, 1937, to determine a possible cause and its origin. It consisted of separating all companies, then paralleling each with W.W.P., one at a time. Frequency of W.W.P. was observed when operating as a single unit, and then, on the same meter, as each company, one at a time, was paralleled with W.W.P. Observations were also made on tie line load. During a portion of each test, the Long Lake frequency controller was taken out of service.

Throughout the test, W.W.P. and P.P.L. acted as a single unit. Speed was regulated at Long Lake with P.P.L. governors blocked. Observations are as follows:

1. When W.W.P. and P.P.L. acted as a single unit, the frequency band increased in amplitude and oscillations were faster.

2. The frequency band was approximately the same when W.W.P.-P.P.L. and Northwestern were in parallel.

3. With W.W.P.-P.P.L. and Montana operating interconnected, there was a decrease in the number of beats per minute, but an increase in the width of the band. Load swings on the interconnecting tie were reduced to one-third the magnitude of the swings with all five systems interconnected.

4. The most pronounced difference occurred when W.W.P.-P.P.L. and Puget Sound were in parallel. Oscillations per minute were less than when operating alone or when interconnected with any of the other companies, and the magnitude of the swings was about half as great.

The controller at Long Lake was readjusted to reduce its sensitivity. No impulses were sent to the synchronizing motor until the frequency had been displaced plus or minus 0.1 cycle. This prevented overtravel by the controller and at the same time held the frequency band close to 60 cycles. The change in the sensitivity decreased the width of the frequency band, reduced the number of load changes made at Long Lake, and improved tie line hunting.

Through the unique suggestion of the radio engineers, the untrapped 150-watt transmitter at Spokane on the Montana-Washington tie line controller was used as a timing device in tests of September and October, 1937, when simultaneous readings were taken on the interconnected system. Observations were taken at fourteen different points, all on 3-in. per min. charts and under several different line load conditions.

Study of these charts revealed the following:

1. P.P.L., again on blocked governors, was not responding to minor frequency changes.
2. Northwestern governors were correcting properly for changes in system load.
3. Puget Sound governors were doing the major correction of instantaneous speed for the entire interconnected system.
4. W.W.P. was helping only a small amount with instantaneous speed, but through the use of its frequency controller (even adjusted at a sensitivity of 0.2 of a cycle) was preventing the system frequency from drifting appreciably from 60 cycles and thereby was maintaining a fair average speed.
5. Action on the W.W.P.-Montana tie was, at least three times out of five, in the wrong direction. During the test, power flow was to Montana. A drop in load on this tie always corresponded with an increase in speed, while an increase in tie line load nearly aways pulled the interconnected system speed down.

This gave a fair reason why hunting on all ties had such similar characteristics. A change in output of Montana prime movers or a change in Montana load was immediately corrected chiefly by the Puget Sound, the swing in load passing through W.W.P. The Morony plant is controlled by the tie line load controller, and any change on this tie line should be reflected at Morony. A partial study showed the action at the Morony plant was at times almost opposite to what it should be. But a check of the load swings at the point of interconnection with the recording phase angle meter at Morony indicated that Morony was receiving in the majority of cases the right signal. This signal must operate through the governor by moving the synchronizing motor and obviously the governor's reaction to these signals is under suspicion.

Following these tests, there was available for a short time a photo-electric frequency meter equipped with an additional pen for recording mechanical movements. This meter is very sensitive and can record frequency changes to .01 cycle and is practically dead beat. The chart travel was 6 in. per min. and enabling the reading of a second in time. The meter element registered frequency and the extra pen was connected so as to record gate movement in response to change in speed.

Only major results will be mentioned. Shuffleton steam plant (Puget Sound) shows a sensitivity of 0.02 cycle, with a dead time of 2 sec. White River plant has a dead time of 2½ to 3 sec. and a sensitivity of 0.03 cycle. Long Lake, with the frequency controller out of service has a dead time of 5 sec. and a sensitivity of 0.11 cycle. Morony sensitivity is estimated at about 0.25 cycle.

With sensitivity varying from 0.02 to 0.25 cycle on the main regulating plants of the three systems, no doubt an even greater difference exists among all the plants. Several changes in speed can be made by a load on any of the several systems and corrected by the more sensitive units without the less sensitive governors recognizing the change.

Another interesting test was the comparison of gate action on one of the Long Lake units with the frequency controller in service. Any change in speed was at once recognized by the frequency controller and a series of impulses sent to the synchronizing motor. But this change in the governor setting was responded to by the gates with so great a time delay that the change in output was increasing at high frequency and decreasing at low frequency. The previously mentioned dead band, to which the controller was adjusted, prevented a substantial portion of this error.

Another peculiarity noticed on the high speed charts taken during the last two test runs was an oscillating motion of a magnitude from zero to 1,500 kw. and an almost exact rate of beat of 2½ sec. In all probability, it is this swing superimposed upon the larger slower swing which causes the maximum swings noted on an ordinary 3-in. chart. This small beat was on all high speed charts recording tie line loads, but was not visible on any recordings made on the generating units or plants.

There is a possibility of this fast oscillation being the torsional stress or synchronizing torque between systems. The fact that it showed on the tie lines and not on the plants may be due to the small quantity involved at any one plant. There is very little possibility of the governors recognizing such a small rapid change, but the inertia of a system as a whole would recognize it and shift phase angle position accordingly. It is felt that this minor hunting should be investigated further.

A possible conflict in the objectives may appear as the whole subject is studied further. Improvement in frequency may have the opposite effect on line swings. It may be possible to make that system with the greatest number of large load changes the speed controlling system with the other systems controlling tie lines. If there is an adverse response on the tie lines with improvement in frequency, it may be necessary to make the controlling system flexible enough to operate at one time with speed control as the primary purpose, and at another time to make tie line control the first consideration with close frequency a secondary factor.

Flat frequency is of little use on more than one controlling plant of an interconnected system where there is the problem of maintaining, at one time perhaps, close tie line regulation, and at another time, a shared responsibility for speed regulation. But selective frequency may at times be useful, and without sufficient experience on the Northwest interconnected system, it is believed that biased frequency control will most nearly solve this part.

Another problem is to decide which plants are to regulate and which plants are not to regulate. Though there is a difference in opinion, it is felt that on each of the systems there should be only one controlling plant. As far as most plants are concerned, it is desired to operate them on base load, and others, which might share the speed regulation, may be equipped with older insensitive governors. Any plant which is helping to regulate speed from flyball action will nearly always interfere with the primary controlling plant. Especially is this so when a tie line is under control. Any governor operating to any extent on a system attempting to maintain a scheduled load on a tie line is biasing the tie line control plant with frequency and may give more bias than desired.

There is another solution which might be feasible; that is, partial control of a governor pilot valve directly from the controllers by small impulses. Both primary and secondary compensations would remain in service though they might require readjustment.

We have enough proof that the controlling plants, be they frequency or tie line control, must be sensitive and as nearly as possible of equal rates of change of output. Perhaps more sensitive governors may increase maintenance due to increased movement. However, it appears logical that the theory, held by many operating men, of the faster the response to any change in system speed (or tie line load), the smaller the movement necessary by the prime mover for correction. A limited experience on other systems has substantially proved this point. The greater the sensitivity of the speed controlling devices, the more movements per unit of time, but the less the magnitude.

Inasmuch as it is uneconomical to attempt the rehabilitation of all governors on a system to give them a sensitivity to prevent unnecessary movements as shown in Fig. 3, they might possibly be blocked or equipped only with shutdown devices. But as a rule for emergency conditions, each unit should have a workable governor and even with a large band of insensibility where it might cause a change in output in direct opposition to that necessary for the correction of speed, this governor should be in operation. To reduce the possibility of faulty action, the insensitivity of the governor can be reduced by considerable increase of its speed droop in comparison to the frequency regulating plant.

Further studies and tests are planned. There is under order at present a

double photo-electric meter so equipped that changes in speed and changes in load on a tie line can be recorded in terms of seconds on the same chart. This meter is also to be used on the generating units. When testing a unit, there will be simultaneous recordings made on a ten-in. strip chart, traveling at 3 to 12 in. per min. of frequency, pilot valve movement, gate movement, and generator output. These data on a unit will measure not only the sentitivity but also the dead time and will show just where that dead time exists, whether in the governor, servo-motor, or water column.

As a suggestion, the following plan could be used as an objective until proven wrong by further tests:

1. That one plant on each system be the controlling plant for that system.
2. That each of these be adjusted to its greatest sensitivity, providing such sensitivity does not exceed the maximum possible sensitivity of the controlling plant of some other system.
3. That each have an equal rate of change of output for the same per cent speed droop.
4. That the central system use a flat characteristic frequency controller adjusted for maximum sensitivity possible with sensitive governors.
5. That the controlling plants on the other systems be equipped with tie line load controllers with ad-adjustable frequency bias.
6. That any other plant, including steam, be so adjusted that it will not interfere with the operation of the controlling plant.
7. That tie line load controlling plants be adjusted with a speed droop slightly greater than the frequency controlling plant.

Electrical Equipment Committee*—Systems Engineering†

Phase Angle Control Experience

By B. W. HAMILTON
The Montana Power Co.

TRANSMISSION systems of The Washington Water Power Co. and The Montana Power Co. (100 kv.) are tied together at Burke, Idaho. With the two systems operating in parallel, power being transmitted from Washington to Montana, it was found that the stability limit of the interconnection was approximately 60,000 kw.

Durng 1937, extreme power shortage in Montana made it necessary to transmit as much power as possible from Washington. This, in turn, required keeping the flow of power through the interconnection as uniform and as close to the stability limit as possible. Manual control, requiring continuous and extreme vigilance on the part of the operator, was, at best, quite unsatisfactory.

To meet this situation, automatic control equipment was installed. It operated to adjust the output of the Montana company's Morony plant near Great Falls in such a way as to maintain as closely as possible a constant phase-angle difference between the voltage at that point and the voltage at the Washington company's East Side substation at Spokane.

This type of control was selected in preference to kilowatts or kilovolt-amperes because it was considered as having the important advantages. By recognizing and controlling for system changes and intervening load changes, it was expected to keep the tie closer to stability limits. In the year since its installation, considerable experience has been gained.

The equipment consists of: a 460-mi. carrier-current channel between the Washington company's East Side substation at Spokane, and the Morony plant of the Montana company, a phase-angle measuring and recording device, and suitable equipment for transmitting the phase-angle indication to the water wheel control governor.

The carrier equipment consists of:

1. A transmitter which is located at Spokane and has a 50 to 150-kilocycle range, 150-watt modulated output, 1,200-watt input, colpitt oscillator, followed with one stage of Class A and one stage of push-pull Class B, provided with plate modulation, and all housed in an outdoor steel cabinet.
2. Surge-protecting equipment embodying a 7.5-kv. de-ion fuse, steel-cabinet-enclosed surge gaps, and one drain coil, all provided for outdoor mounting.
3. Receiving equipment composed of a detector and two stages of resistance coupled amplification and provided with a range of 50 to 150 kilocycles, 85-watt input and 1-watt audio output.
4. Line coupling capacitor made up of three .00375-mfd., 25-kv., suspension-type capacitors connected in series having a final capacity of .00125 mfd.
5. A line tuning inductance for resonating with line coupling capacitors.

The phase-angle measuring and control equipment, located at Morony, consists of a Leeds and Northrup combination receiver, controller and recorder combined with a Westinghouse phase shifter, and an automatic droop control. The component parts are: (a) phase shifter, (b) phase angle recorder, (c) phase-angle indicator, (d) phase-angle controller, (e) frequency controller, (f) impulse integrator, (g) automatic droop control.

In operation, the voltage at the Morony plant is compared with the voltage received from the East Side substation (Spokane) in time position or angular displacement by means of the phase shifter and phase-angle recorder and indicator; then, the angle is controlled to desired adjustable settings through the automatic control of the kilowatt output of the Morony plant. Four types of control can be secured.

1. *Phase Angle*, under which the equipment controls for a constant value of the phase angle as set.
2. *Biased Frequency*, under which the control is primarily for a constant value of phase angle, but assistance is given for short periods in the control of system frequency whenever the frequency is not at 60 cycles at the time the phase-angle controller sends a changing output impulse to the Morony generators.
3. *Selective Frequency* under which the control is for a constant value of system frequency but impulses to change Morony output will only be made in a direction to assist in holding the set value of phase angle between the systems.
4. *Flat Frequency* under which the control is for a constant value of frequency of the system on which the plant is operating. This is used only when the Montana system is not in parallel with Washington.

First experience in the operation of this equipment was that the phase angle

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changed very rapidly and the first instrument furnished with the equipment was too slow properly to record the phase angle. This slowness resulted in incorrect impulses being sent to the governor control equipment. For example, the recording and transmitting equipment would lag far enough behind the actual phase angle to cause a raising impulse to be sent to the governor, when the actual phase angle required a lowering impulse. This was corrected by the replacement of this instrument with one that was approximately 600-per-cent faster.

Operating experience with the Montana-Washington automatic phase-angle control has shown that to transmit 40,000 kw. over the tie point at Burke, Idaho, it is necessary to maintain approximately 60 deg. difference between Spokane and Morony voltage vectors. This does not, however, represent the total phase angle of the tie line but does represent the total phase angle between Spokane and Anaconda, minus the phase angle between Morony and Anaconda.

This then brings to light the desirability of locating the phase angle control equipment as near to the end of the tie line as possible in order to eliminate outside influences and to gain the greatest control of the tie.

The interconnection between Montana and Washington has been very difficult from the standpoint of power fluctuations. These fluctuations have a time interval of about 22 sec. from minimum to maximum of swing. These swings have not been lessened to any extent by the installation of the phase-angle control equipment.

Attempts have been made to speed up the action of the controller in order to eliminate the swings but these attempts have resulted in greater and more rapid swings. A good deal of this trouble has been laid to the lag present in the hydraulic equipment that is controlled by the phase angle.

However, the solution does not lie in the ultra high speed controller but in the correction of the cause. This cause is the incoordination of the control equipment and automatic controllers in the system.

There is a power drift across the tie line that is not accompanied by a change in the phase angle, undoubtedly due to loading the tie line and system at different points. The drift has a period of about 15 min. and amounts to about 6,000 kw.

The operation of the carrier has been very satisfactory, operating from phase to ground over a distance of 460 mi. It is very seldom that a signal failure occurs due to storm conditions, and equipment has required no maintenance in the time it has been operating, except cleaning and oiling.

The impulse integrator that was furnished with the original equipment has not been in service when operating on tie line control or when operating on flat frequency. It introduces too much lag but would reduce wear on equipment if high speed were not required.

Adjustment of the equipment was accomplished by operating the equipment for a certain length of time and then analyzing the chart of power flow into Montana.

The automatic droop control was not furnished with the original equipment but was added in order to prevent over-running of control. It consists of a motor operated rheostat which advances the control point of the controller toward the chart indication and establishes an artificial zero point. The controller will control to this new zero point, then the droop controller will gradually lead the control into the true zero but at a very slow rate, thus preventing over-running.

Installation of the control has relieved the operating personnel of much of the tedious watching of the power interchange, decreased the number of telephone calls between the operators and the dispatcher and minimized the manual operation of the controlling plant.

Since the first attempt at control, considerable improvement has been made in operation. The foregoing can be viewed as a report of progress, since study continues, looking toward refinement in both equipment and its use.

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Tie-Line Control with Frequency Bias

By E. L. WHITE
Puget Sound P. & L. Co.

LOAD adjustments on electric generators normally are made either by hand or automatically by governors. Since governors are responsive to changes in speed or frequency only, it follows that the generators whose output they control will attempt to share sudden load changes in proportion to their individual response characteristics. The magnitude of the load change finally taken by any one generator depends upon the characteristics of its governor and its electrical distance from the load as compared with the governor characteristics and location of all the other generators connected to the same load.

It is apparent that in a system involving two or more companies interconnected by tie lines, load changes are shared by all the companies unless precautions are taken. If these precautions involve telephoning, several minutes may elapse between the change in load and the final load correction. Even when telephoning is not required, many may be required. This delay may become very important. Even when there is no actual damage the efficiency of the interconnection as a unit will be lowered. Several equipments are available for obtaining constant, or nearly constant tie line loads. These devices fall into three general classifications.

1. Flat Tie Line Load Control.
2. Frequency Control with Load Bias.
3. Load Control with Frequency Bias.

"Load control with frequency bias" means "flat tie line control" with the action on the synchronizing motors delayed or accelerated by the amount and direction of system frequency shifts. Equipment of this type is now being placed in operation between the systems of the Washington Water Power Company and the Puget Sound Power & Light Company, and this paper will describe the equipment and the principles of operation.

Description

The tie line whose load it is proposed to control extends from Chelan Falls to Wenatchee, 43 mi. The line operates at 110,000 volts, and is constructed of 250,000 circ. mil. stranded copper on H-frames. Anothr tie line also connects the two companies, but since it is approximately 175 mi. long and is constructed of No. 0 stranded copper, its effect as a tie line is small compared with the Chelan-Wenatchee tie. The second line, however, has a large railroad load connected along its length, and it is expected that the magnitude and location of this load will affect the proportion of inter-company power transmitted over the Chelan-Wenatchee line.

The station chosen to regulate the tie line load is the White River station of the Puget Sound company. This station is 110 mi. from Wenatchee via a 2/0 copper, 110-kv., H-frame line, and is 153 mi. from Chelan.

Briefly described, the equipment consists of a carrier current telemeter circuit operating between Chelan and White River, with contact-making devices at the White River end to operate the generator governors whenever the tie line load departs from predetermined amounts. Fig. 1 is a simplified block diagram of the complete installation.

Transmitting Equipment

Only the Chelan equipment is shown in Fig. 2. It includes a carrier current transmitter, audio frequency oscillator for modulating the transmitter output, and a telemeter. The current and potential transformers measuring the tie line load are connected to a polyphase wattmeter element of the telemeter. The output of the telemeter is a direct current whose polarity and magnitude represent respectively, the direction of power flow in the tie line and its magnitude. This direct current is used to control the frequency of an audio oscillator whose output is combined with, or modulates, the output of the carrier current transmitter. The modulated carrier wave therefore represents at each instant the magnitude and direction of the tie line load, and is impressed on one of the transmission line conductors through the coupling condenser.

Receiving Equipment

The White River equipment is divided into two groups as shown in Figs. 3 and 4. Fig.

3 includes the carrier current receiver, audio amplifier, two telemeters, and associated protective devices and recording instruments. The carrier wave transmitted from Chelan is taken from the transmission line at White River by means of a coupling condenser and impressed on the receiver where it is amplified and detected. The resulting audio frequency signal which represents the instantaneous direction and magnitude of the power flow at Chelan is amplified and impressed on the watt-load telemeter. The output of this telemeter is a direct current which varies with the audio frequency input and whose polarity and magnitude represent, respectively, the direction of tie line power flow and its magnitude, at Chelan.

The other telemeter (frequency bias) has its measuring element (a frequency meter) connected to the station a.c., 110-volt bus, and its output is a direct current corresponding in polarity and magnitude to changes in system frequency above and below 60 cycles. Adjustments are provided in this telemeter for varying the direct current outputs corresponding to frequencies above and below 60 cycles, independently of each other.

Load Controller

Fig. 4 shows the load controller, master selsyn, governor selsyn, and associated hand control and protective devices. The outputs of the watt-load and frequency bias telemeters are combined in the load controller in a direct current milliameter which is part of an optical-photoelectric system. This system in turn controls the action of two thyratron tube and relay circuits and regulates the length of time the master selsyn drives the governor selsyns and also their direction of rotation, the maximum length of such impulses being two seconds. This 2-sec. interval is fixed by means of a Warren motor with associated relays and contactor and can be varied only by replacing the Warren motor reduction gear.

Five adjustments are included in the load controller; the tie line load which is to be maintained, dead bands above and below the tie line load, and sensitivity adjustments above and below the dead band.

The "dead band", positive or negative according to direction, is the amount of load departure from the desired tie line load, which will just cause the load controller to operate the master selsyn.

Sensitivity, in either direction, is the amount of load departure in excess of the dead band which will cause the load controller to operate the master selsyn for a full 2-sec. interval.

It is evident the length of time which the load controller will drive the master selsyn for any given tie line load change depends upon the amount by which the change exceeds the dead band, and the ratio of this excess to the sensitivity adjustment. For example, with a dead band of 1 megawatt, a sensitivity of 16, and a load change of 5, all in the same direction, the length of the resulting impulse to the master selsyn will be 4/16 of two seconds, or ½ sec.

Tie line load changes which exceed the sensitivity adjustment will cause continuous selsyn operation until the load change is reduced to less than the sensitivity adjustment, or until the gate stops on the water wheels cut out the automatic control on individual governors. This operation is not truly continuous, but the pauses between the 2-sec. timing intervals of the load controller are so short that the inertia of the master selsyn and its driving motor is sufficient to bridge the gaps without perceptible pause.

Frequency Bias

The action described above is "flat tie line control", because the load controller attempts to correct all tie line load changes, regardless of the point on the interconnected systems at which the changes occur. Since this method of correction would cause large load swings in the White River output, the frequency bias output is introduced with the proper polarity to delay the corrective action of the load controller when the change in tie line load is due to fluctuations on the Washington system, and to accelerate this action when such changes occur on the Puget Sound system. Table I shows typical examples of the effect of the frequency bias. The assumptions have been made that the changes in company loads are approximately equal in magnitude, and that the load controller is adjusted for power flow toward Washington.

Governor Control

As indicated in Fig. 4, the actual control of the governor synchronizing motors is through a selsyn motor system. This system consists of two relays, a d.c. driving motor, a master selsyn motor, and 4 small governor selsyns. The relays, which respond to "raise" and "lower" impulses from the load controller, control the action of the d.c. driving motor. The rotor of the master selsyn is connected to the driving motor through a gear train whose ratio is adjustable in three steps. The a.c. output of the master selsyn is connected to the governor selsyn units through test switches, one for each governor.

(Top to bottom): Fig. 1—Simplified diagram. Fig. 2—Telemeter transmitter, Chelan. Fig. 3—Telemeter receiver, White River. Fig. 4—Load controller, White River

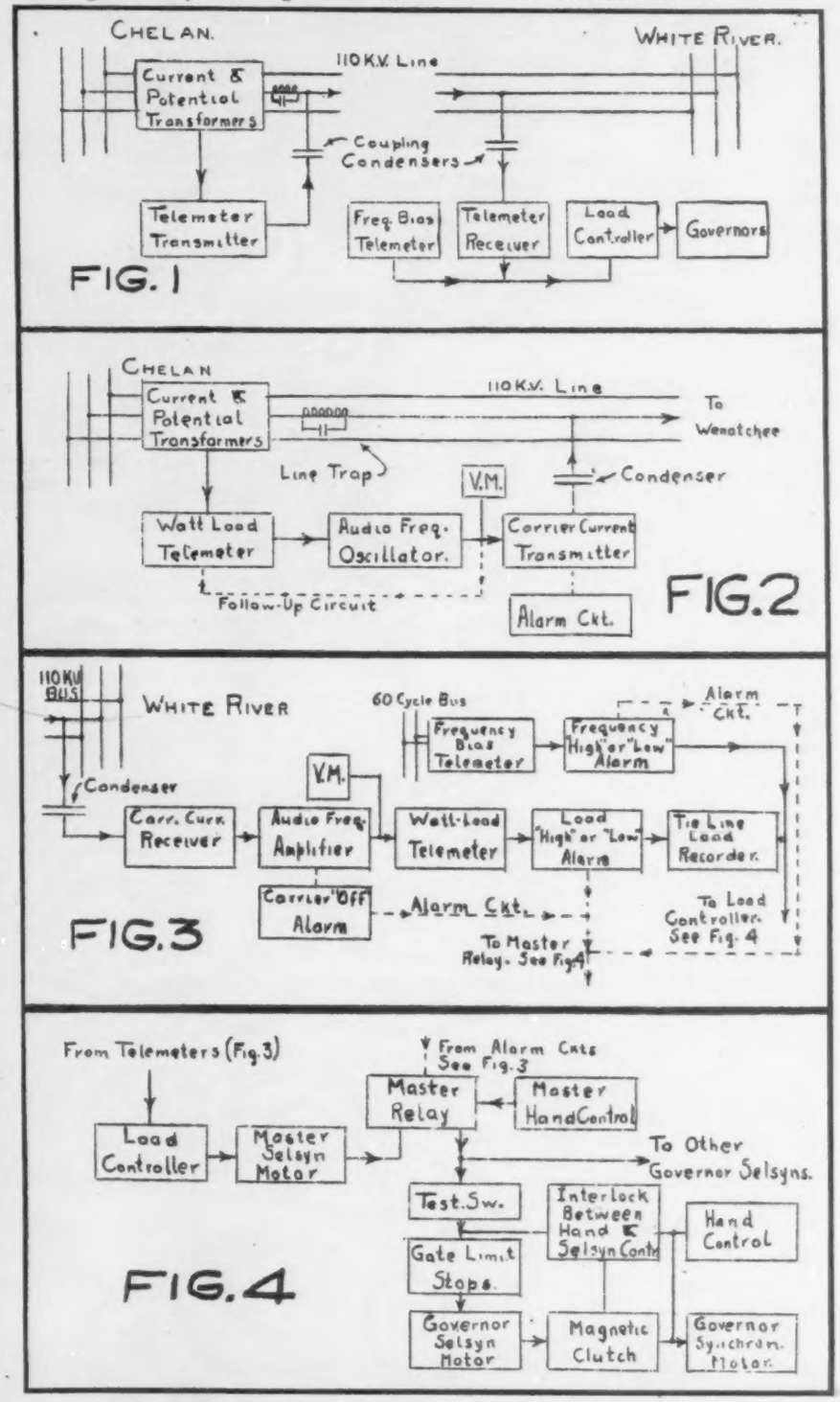

Table I—Effect of Frequency Bias

Load Change		Change In		
W. W. P.	P. S. P. & L.	Tie Line	Frequency	Effect of Frequency Bias
Increase	None	High	Low	Delay Tie Line Correction
Drop	None	Low	High	Delay Tie Line Correction
None	Drop	High	High	Accelerate Tie Line Correction
None	Increase	Low	Low	Accelerate Tie Line Correction
Increase	Increase	None	Low	Frequency Correction Only
Drop	Drop	None	High	Frequency Correction Only
Increase	Drop	High	None	Tie Line Correction Only.
Drop	Increase	Low	None	Tie Line Correction Only.

The rotor shaft of each governor selsyn is threaded into one end of a long nut which does not turn but moves laterally along the shaft. The governor synchronizing motor is connected by a worm gear and magnetic clutch to the other end of the same nut. Associated with the long nut is a single-pole, double-throw contact which operates the synchronizing motor in a "raise" or "lower" direction whenever the nut is moved away from the neutral position of the switch. The directions of rotation of the selsyn motor and the synchronizing motor during any one operation are arranged to drive the long nut in opposite directions. In other words, any motion of the selsyn which is sufficient to close one or the other of the switch contacts will cause the synchronizing motor to run until the switch contact reopens.

The gear ratio in each governor selsyn unit is designed so that 60 revolutions of the selsyn motors will operate the governor settings from no-load to full-load. The time required to make this number of revolutions may be 30, 45, 60 sec., depending on the gear ratio in the master selsyn drive mentioned above.

Since the maximum length of impulse delivered to the master selsyn by the load controller is two seconds, the maximum amount of governor movement which can be caused by one load controller operation is 2/30, 2/45 or 2/60 of the no-load, full-load movement, depending on the master selsyn gear ratio. Assuming straight line response between gate opening and generator output, and a station capacity of 60,000 kw., the maximum load changes corresponding to a full two-second impulse are 4,000 kw., 2,666 kw., and 2,000 kw. Actually, of course, the output curve is not linear and the load change varies with the amount of load already on each machine.

Equipment has been provided for giving an alarm under any of the following conditions:

At Chelan:

1. Failure of Transmitter output.
2. Failure of Audio Frequency modulation.

At White River:

1. Failure of combined carrier current receiver and audio amplifier output.
2. Failure of vacuum tubes in Megawatt and Frequency Bias Telemeters.
3. Extreme frequency swings, variable up to 1 cycle on either side of 60 cycles.
4. Extreme load swings, variable up to 50 megawatts in either direction of power flow.

At White River, in addition to sounding an alarm, the master relay (Fig. 4) is tripped out of the circuit. This relay disconnects the automatic control system from the governors and can be restored only by hand operation after the faulty condition is remedied.

Each governor at White River is provided with "full gate", "no-load gate", and "load limit" stops, which interrupt the magnetic clutch circuit when operated. The governor is thereby disconnected from the load controller, and automatic control cannot be restored until the machine is moved away from the "stop", either by manual operation or by action of the governor fly-balls. Additional relays are being installed which will correct this situation by restoring automatic control with the first load controller impulse in the direction opposite to that which caused the "stop" operation.

Test switches are provided for each governor selsyn unit which open the 5-wire selsyn circuit and the magnetic clutch circuit.

The hand governor control switch is interlocked with the automatic control by means of extra contacts on the usual "raise" and "lower" control switch. These contacts open the d.c. supply circuit of the magnetic clutch in the governor selsyn unit and the synchronizing motor can be rotated without interference from the automatic equipment. Automatic control is restored at the new load condition as soon as the hand control is released.

It is evident that any desired load sharing adjustment can be made by means of the hand governor controls. The differences thus set up in load adjustment of the several generators will not be affected by the automatic control unless one or more of the gates comes up against a stop. If the other machines continue to correct the tie line load they will alter the initial load adjustment between machines. Thus, when the load swing is corrected and the gates move away from the stops a new load sharing adjustment will be set up which may differ from the original adjustment by a wide margin. This change in adjustments is serious from the standpoint of water economy and plant efficiency and will undoubtedly require manual correction by the operator until some scheme of automatic readjustment is worked out.

Operating Experience

At the time of writing this paper, the telemeter and tie line load recorder have been in operation for about three months. At first, some difficulty was experienced with the tie line load recorder, due to fluctuations in power supply to the carrier current receiver and audio frequency amplifier. This condition has been remedied by installing a voltage regulator, and the charts drawn by the recorder now agree very closely with wattmeter charts taken directly on the tie line.

When the governor selsyn equipment was first placed in operation, difficulties were encountered due to the inertia of the synchronizing motors. Long impulses from the load controller would cause the motor to attain full speed, and its inertia would permit it to coast for several revolutions after being disconnected. This action, by driving the long nut along the shaft of the governor selsyn and thus closing one side of the single pole double throw contact, frequently resulted in one or two additional operations of the synchronizing motor before it finally came to rest. A tentative solution has been found and will be tried out soon.

Owing to the difficulties with the synchronizing motors, no tests have been scheduled so far to determine the effect of frequency bias, dead band, and other adjustments. However, the equipment has been controlling the tie line load, using the initial adjustments, with very good results as far as average tie line load is concerned.

Electrical Equipment Committee — Meters, Services*

Reconstructing Old Meters

By L. H. KISTLER
Northwestern Electric Co.

SINCE the advent of the socket-type meter in 1934, considerable progress has been made in conversion methods and equipment. Because the advisability of spending money on old meters to bring them up to date has been questioned at different times, tests have been made to throw further light on the question.

From a questionnaire mailed to 14 member companies, 11 were returned. Nine of these reported reconstruction programs. Portions of the answers susceptible to tabulation appear in Table I. The letters at the column heads refer to companies as follows:

a. Washington Water Power
b. Puget Sound P. & L.
c. Portland General Electric
d. Pacific P. & L.
e. Utah P. & L.
f. California Oregon Power
g. Mountain States Power
h. Eastern Oregon L. & P.
i. Northwestern Electric

Following are replies to the question: Do you have any special labor saving methods or devices used in converting old style meters to socket type?

a. Special chuck in lathe for cutting bases.

b. Conversions are made in groups of ten. Operations are performed in sequence on the whole group.

c. Bases of type I-14 meters are clamped to a gauge and sawed off with a band saw. Small electric soldering iron with carbon tips heated with high current from transformer is used to unsolder clips from ends of leads. Eyelets are clamped on ends of stranded wire leads with hand clamp device. Connecting sleeves are shaped by a hand punch with wide tip and a steel block with small groove for holding sleeve. Holes in the

* A. H. Kruel, Portland General Electric Co., Chairman; B. C. Electric Railway Co., P. C. Gill; The Montana Power Co., E. W. Williams; Northwestern Electric Co., L. H. Kistler, S. B. Clark; Pacific Power & Light Co., J. D. Hertz; Puget Sound Power & Light Co., C. S. Alger; Sangamo Electric Co., T. S. Wood; Utah Power & Light Co., J. H. Stayner; The Washington Water Power Co., K. C. Finley.

Tabel I—Meter Conversion Experience

Company	a	b	c	d	e	f	g	h	i
Number converted..	1,500	8,630	26,000	6,250	9,000	6,807	1,700	1,200	6,500
Types converted....	I-14 I-16	OA OB I-14 I-16	I-14 & I-16 H & HC DA OB	I-14 I-16	OA I-14	I-14 H OA	I-14 I-16 OA H & HC	OA OB I-14 I-16	I-14 I-16
Temp. compensation added at time of conversion to	None	OA OB	All types.	I-14	OA I-14	All types	I-14	I-14	All types.
Costs: parts	$2.00*	1.37-2.59*	1.50-1.75	1.65-1.86	3.13†	1.78	1.50*	(next line)	1.50-1.75
dismantling—reassembling	.85	.34- .75	.70	(next line)	.50	(next line)	.75	4.85	(next line)
re-calibrating ...	..	.55- .60	.35	1.00	.10	1.12	.30	.50	1.25
credit for salvage of parts	..	.00- .05	....	..	..	0	0	0	.10
credit for cleaning, etc.	..	.10	....	0-2.00	.10	..	.20	.25	.40
credit for calibrating	..	.40- .45	....	.30	.10	..	.20	.25	.25
Rewind and rebuild for higher capacity.	No	OA	No	No	No	Yes	No	No	I-14
Disposition of old types not suited for conversion	Mostly junked.	Try to install.	Scrapped.	Reinstall.	Reinstall or junk.	Junked.	½ returned. ½ retired.	Junked.	

* Excluding socket. † Including socket.

nameplate of I-14 meters are located in a fixed place by means of a slotted templet. Similar holes in the frame studs for holding nameplates are located to match the nameplate holes by means of a templet clamped to the frame of the meter.

d. In most districts bases are farmed out to be cut off at a cost of 10c each. The drilling and tapping of nameplates and nameplate mounting screw holes are done at a cost of 2c each. Shop work is organized so as to avoid unnecessary repetition of motions.

e. Manufacture clips for preventing curling of I-14 face plates (register) when installed out-of-doors. Also attachments for nameplates.

f. Use band saw with automatic feed so that when a meter is placed on the saw, no attention is required while operation is performed. Very satisfactory.

g. Meters are worked in groups of 10 or 20. The work progresses by performing each individual operation on the group as a whole.

i. Special chuck for lathe for cutting off bases of I-14 and I-16 meters without dismantling light load and lag adjustments. Shears for cutting leads and insulation to length. Special clips for mounting nameplates to save drilling and tapping. Magnet testing device to determine if magnet has sufficient strength to permit use of temperature compensating device. Tool for cutting nameplate rivets and sealing studs. Special containers for holding all parts of each meter to keep together, and prevent damage to delicate parts. Meters are handled in groups of 20 and are moved on a portable table holding the full group. Template for drilling and tapping dial faces to prevent curling. Register checking device to check register ratios quickly. Special support for holding electromagnets while extending leads.

Some important data were appended to replies on the question: Do you rewind or rebuild old style small capacity meters for use on larger loads?

Puget Sound Power & Light reported converting a number of 5-amp., 120-volt, 2-wire I.A. meters to 10-amp., 120-volt, 2-wire by rewinding the coils. Cost was reported at 35c in connection with the conversion program if done in lots of 50. Conversion of 5-amp. O.A. meters to 15-amp., 3-wire meters is under consideration.

Northwestern Electric having undertaken considerable study in this field reported as follows:

We rewind most of the 5-amp., 120 volt, 2-wire, I-14 meters which are converted as 2-wire meters to have a rating of 10 amp., 120 volts. This is done primarily to provide increased capacity, but we have observed that the insulation on 5-amp. meters is at times found to be charred and in doubtful condition to use ahead of fuse protection. New insulation is provided and new coils are wound with 10-amp. capacity. The only other change required is to use a worm shaft in the register with a double-pitch worm to provide the proper register ratio.

A considerable number of 5-amp., 2-wire, I-14 meters are rewound to have a rating of either 15 or 25 amp., 240 volts, 3-wire, for range use. This is done by installing 240-volt potential coils purchased from the manufacturer and rewinding the current coils for the 15 or 25-amp. 3-wire ratings.

We have found that it is easier and cheaper to make a 25 amp., 3-wire meter than a 15 amp. capacity, as the coils are simpler to make. Tests show the average accuracies of the 25-amp. meter to be equal to the 15-amp. size. We have remodeled an old foot-operated punch press to stamp out the various pieces of insulation, and can make a very satisfactory coil. Of course, leads are provided of suitable length so that no splicing is required. Cost data are:

To convert 5-amp., 120 volt, 2-wire meter to 10 ampere 120 volt 2-wire at time of conversion to socket type:

Double pitch worm	$ .10
Wire for coil	.05
Labor on register	.10
Labor on coil	.50
Total Additional Cost	$ .75

To convert 5-amp., 120-volt, 2-wire meter to 15-amp., 240-volt, 3-wire at time of conversion to socket type:

Register parts	$ .43	
Wire for current coils	.10	
Potential coils 240 V	2.10	(Net)
*Conversion parts	2.00	(Net)
Temperature compensator	.15	
Labor on register	.40	
Labor on coils	.40	
Conversion Labor and Testing	.60	(Net)
Total Cost	$6.18	

* Present Prices

To convert 5-amp., 120-volt, 2-wire meters to 25-amp., 3-wire 240-volt meters at time of conversion to socket type: $6.03.

Net price for the 240-volt potential coils allows 50c for the old 120-volt coil which will have a value if and when a 120-volt replacement coil is needed. Over a period of time, a quantity of these coils will be needed. The net price of the conversion parts allows 10c for parts salvaged and the net cost of labor allows 65c for unnecessary labor not

Table II—Range Set-up

Total Readings—Locations 1, 2 and 3

Date	I-30S (15 A.)	CS (15 A.)	I-14 (25 A.)	I-14 (15 A).*	I-14 (15 A.)**
2/14/38	246.5	247.4	248.7	247.7	247.2
3/1/38	622.1	623.2	627.3	625.2	622.9
3/14/38	945.5	948.0	952.4	949.9	948.8
4/1/38	1363.6	1367.3	1373.2	1366.9	1369.2

Table III—2-Wire Light Set-up

Table III—2-Wire Light Set-up

Date	I-30S. (5A.)	CS (5A.)	I-30S (15A.)	I-14 (5 A.)	I-14 (10 A.)
2/21/38	133.7	134.0	133.2	131.7	132.3
3/1/38	246.2	247.0	246.5	245.0	244.6
3/14/38	356.4	359.8	357.1	356.8	355.7
3/31/38	517.4	517.6	515.1	514.9	513.5

done on old style meters if used as such. These costs can, therefore, be compared to a present cost of a comparative 15-amp., 240-volt, 3-wire meter of $9.38, which includes a charge of 50c for shop test and stenciling which is included in the above expense for reconstructing. Therefore, a net saving of $3.20 and $3.35 respectively for the 15 amp. and 25-amp., 3-wire meters is made since there is no market for the old style 5-amp. 120-volt meters. This work furnishes employment for local labor—often for older employees otherwise unsuited for other employment, or as a fill-in job for regular employees.

To satisfy ourselves that the reconstructed meters were sufficiently accurate for modern loads, some test set-ups were assembled, 3 for range service and 3 for 2-wire light service. These were installed in employees' homes for convenience and accessibility. It was also thought that the consumption would probably average higher, therefore furnish a more severe test.

The tests were conducted for a period of 2 months—from Feb. 1, to March 31, 1938. Each meter was very carefully calibrated at 10% and 100% of rating and adjusted to within 1/10 of 1% correct. Check tests were made at the end of the first month and all meters were found to be within ¼ of 1% correct at 10% and 100% of rating. Final tests were made at the end of the second month and all meters were found to be within 4/10 of 1% at 10% and 100% of rating. The standard routine for meter tests in our company is to adjust meters to within ¼ of 1% of correct registration at both 10% and 100% of rating, in both shop and field tests. Accuracies at other values of load may vary slightly and for heavy overloads the older meters will, of course, be somewhat slow. All potential circuits were connected ahead of meters to prevent errors from this source. Results appear in Tables II and III.

Analysis of the test data will indicate that while local conditions somewhat affect the relationships of registrations of the various types of meters, the totals or averages of the three range set-ups show the rebuilt I-14 meters to usually register more kw.-hr. than either of the new types tested, while the rebuilt 25 amp., I-14 meters register more than the rebuilt 15-amp. meters. The rebuilt 15 amp., I-14 meter with the standard jewel and pivot registers less kw.-hr. than the same meter with the ball bearing jewel and pivot.

Analysis of the light set-ups shows that the rebuilt meters are sufficiently accurate for all practical purposes. The totals of the three installations show the two new 5-amp. meters to register the most kw.-hr., while the new 15 amp. meter shows slightly less kw.-hr. and the rebuilt 5-amp. and 10-amp. meter slightly less kw.-hr. in the order named. The total difference between the fastest and slowest meter is but less than 0.8% on the average.

The conclusion is therefore evident that the meters tested show that this type of meter is worth saving by converting to socket type, and that a program of rewinding surplus 5-amp., 2-wire, 120-volt meters to be 15 or 25-amp., 3-wire 240-volt meters is justified.

Meter Bearing Survey

By C. S. ALGER
Puget Sound P. & L. Co.

GREAT interest is being displayed at present in watt-hour meter bearings, particularly the lower bearing, upon which sustained accuracy greatly depends. Sustained accuracy, aside from its importance to revenue, leads to other economies in testing, the most significant being the tendency of regulatory bodies in all parts of the country to recognize improved performance by allowing longer periods between routine tests. Coincident with this trend comes the intensive use of outdoor metering. The effect of these changes on the performance of meter bearings is a matter for conjecture since the facts will probably not be known for several years.

A preference expressed by many utilities for the ball-type lower bearing, and agitation for a standard bearing with a twenty-year life, have undoubtedly been partially responsible for the recent improvements in pivot bearings and the development of better oils.

A standard, and possibly a universal bearing, is unquestionably desirable, and while the ball bearing is favored for this purpose at the present time, careful consideration should be given to the developments in pivot bearings since such consist of only two parts and are more easily manipulated.

In reply to a questionnaire on meter bearings, included as an appendix to this paper, all of the seven Northwest companies favored the ball type as compared to the old style pivot. Two, however, reserved judgment pending performance data on the new pivot bearings. This response clearly indicates why all manufacturers now offer a ball bearing which may be obtained as optional equipment, but it by no means proves the superiority of that device.

One company having 90 per cent of its meters equipped with ball bearings reports low maintenance costs and greater sustained accuracy than for pivot equipped meters. Another company reporting the results of microscopic bearing examination by types of meter shows a mortality from two to five times higher for the pivot as compared to the ball. These results undoubtedly prove the superiority of the ball bearing over the old pivot type but do not offer convincing proof that it excels the improved pivot bearings.

The relative merits of the two bearings as they are made today can only be determined through a study of performance. The ball bearing has been in use for over 30 years with little change in materials or design, and during that time has established records of superior performance. This bearing would be improved if a non-corroding ball having the same wearing qualities as the present carbon steel ball could be produced. So far, a suitable material which can be properly and inexpensively formed has not been found. On the other hand there have been a number of developments in pivot bearings which offer a wide field for study.

Two manufacturers have developed pivot bearings along similar lines both calling for oil in copious quantities although the jewel and pivot material are different. One uses a natural sapphire and a cobalt tungsten pivot while the other uses a synthetic sapphire and a more complex pivot alloy containing chromium and other noble metals as well as tungsten and cobalt. A mixture of mineral and fish oil is recommended for the first combination, while a pure mineral oil is recommended for the latter.

The third pivot assembly offered is a departure from conventional design. The pivot bearing surface is relatively soft being an inset of an alloy in which gold and platinum predominate. It is claimed that the low inherent friction between this material and sapphire permits a considerable increase in bearing area reducing the unit pressure on the jewel to less than 1 per cent of that for the ball or pivot. A synthetic sapphire is used, and oil is considered unnecessary and is not recommended. The clearance angle on the special point is greatly increased compared to the relatively acute angle on other forms of pivot. This design, it is claimed, together with the absence of oil will materially decrease the drag effect of accumulated dirt and eliminate similar effects from gummed oil.

There has also been proposed an upside down pivot bearing in which a jewel backed by an enclosed oil reservoir is attached to the meter shaft, the pivot being mounted in what is now the jewel screw. It is claimed that the jewel surface is kept oiled by capillary action and surface tension and that due to the inversion of the jewel cup any debris slides away from the bearing point, thus removing one serious objection to the ordinary pivot bearing.

These developments offer many combinations for comparison with the ball bearing and among them it is entirely possible that a combination superior in performance to the ball bearing may be found. Since there is this possibility it is probable that many investigations will be made by interested parties. Such investigations have been made before but under various conditions and in different ways, making it difficult to correlate the results. It is suggested that some authority, possibly one of the

meter committees, develop a standard procedure for conducting bearing tests and observing performances which will produce the most significant results. Many individual tests or observations conducted in this manner should provide data of such scope that when submitted for analysis would permit definite conclusions to be reached in a relatively short time.

More conclusive evidence of the superiority of the synthetic sapphire is needed. Five of the Northwest companies favor the synthetic jewel since they purchase them for replacements. The synthetic material should be the best, providing it is properly polished and free of stresses, since it does not contain the inclusions and soft spots common to the natural variety and which often occur close to the surface and may break through in the course of normal wear or due to short circuit impact.

Much has been said on the subject of oiled versus unoiled lower bearings but it appears that the best performance has been obtained by using oil. Whether this will continue to hold true with the new pivots and extended test periods is a matter for further investigation. Oil in a pivot bearing is probably not very effective as a lubricant since bearing pressures are frequently so high that there is little chance for an oil film to exist between the pivot and jewel. In the case of the steel pivot it serves its purpose in preventing oxidization and the formation of rouge which is sufficiently abrasive to cut the sapphire jewel. The reason for using oil with non-ferrous pivots is not so clear, although it may be said that the oil does supply some lubrication and serves as a vehicle for removing the products of wear and other foreign particles from the vicinity of the bearing point.

The type of oil used will become a more important factor with the increasing use of outdoor metering and extension of test periods. An oil used in meter bearings must have a low evaporation rate, provide adequate protection from corrosion, and have a low viscosity change over a relatively wide temperature range. It should be non-acid forming and have a low creepage value. To meet these requirements the trend is toward the more stable mineral oils and away from fish oils which held favor for some time.

In regard to maintenance of meter bearings several items of interest are brought out in replies to the questionnaire.

Five companies use the needle for inspecting jewels, two now use microscopes and two of the five are considering similar equipment. The two using microscopes previously used the needle method, but found it unsatisfactory. Small imperfections in the jewel visible in the microscope can easily be passed up with a needle, a weakness in the method which is readily demonstrated by exploring a dirty jewel with a needle and then examining under the microscope. Wide unexplored areas between the tracks of the needle are usually found. Encrusted dirt on the jewel which is not removed by ordinary methods of cleaning may be interpreted with the needle as roughness, resulting in the discard of good jewels, or improperly cleaned jewels may be returned to service. The pressures which can be applied in exploring with a needle may easily damage the jewel, particularly if stresses exist or there are inclusions near the surface.

Methods of examining pivots and balls are varied, but because of the smallness of these parts it is difficult to accurately determine their condition by any means other than the microscope.

The two companies using microscopes do not examine bearings in the field but replace them with inspected parts, the removed parts being reconditioned in the shop.

Six companies report that they oil pivot bearings. Five of these use the same oil, which it is understood contains approximately 75 per cent mineral oil and 25 per cent fish oil. One company uses pure fish oil. No comparative data on the relative life of the oiled and unoiled bearing could be obtained, although two companies believed the oil bearing had a longer life.

No performance data could be obtained on the stainless steel ball bearings now being offered, but one company reported several hundred under observation. There appears to be some question as to whether balls of this material are sufficiently hard and also in regard to the possible formation of chromic oxide which may scale off, retarding the motion of the ball.

Two companies reported that they examined lower bearings of new meters and another is considering this practice. It is believed that this is a desirable procedure providing a microscope is available and particularly for those companies operating with extended test periods.

No information could be obtained regarding the effect of outdoor metering on bearing life except a statement by one company that, in general, bearing replacements are higher for meters which had been in service outdoors for a number of years.

Four companies do not examine new replacement parts. The two companies having microscopes did examine these parts but have either discontinued the practice or examine parts only when the source of supply is changed. One company examines parts with a glass and needle but states that the few rejections hardly warrant the additional work.

Considerable care is exercised by all companies to protect bearing parts until installed in the meter. Containers or capsules for all parts are used and the handling of balls or pivots is carefully avoided. Several devices are available for carrying and dispensing steel balls. These may be loaded directly from factory container eliminating possible exposure to dust or moisture.

In conclusion, it may be stated that the economies of longer test periods are highly desirable but will only be justified by sustained meter accuracy over the period selected. To achieve and maintain satisfactory accuracy, meter bearings must be of a type which will operate under the more severe conditions imposed by outdoor metering, further investigation being necessary to determine the most suitable combination for this service. In addition, the adoption of improved methods of inspection will eliminate errors resulting from the utilization of defective parts. Wherever possible, records of the number of bearing parts of various types inspected should be kept showing the number salvaged and the nature of the failures encountered. Such records would be valuable contribution in judging the merits of the various bearings available and assist materially in reaching sound conclusions regarding a standard bearing.

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Appendix—Condensed Replies to Meter-Bearing Survey

1. Method of Examining Lower Bearing Parts—Results Obtained:

Four companies examine jewels with a needle. One company with a needle and strong glass, and two with a microscope. The two now using microscopes had previously used the needle method but found it unsatisfactory.

Pivots and balls, where not examined with a microscope or glass, are changed when the jewel is replaced or if badly worn.

The salvage of bearing parts during the routine tests was variously estimated at from 30 to 40% for pivot type and 60 to 90% for the ball type.

2. Use of Oil

Six companies reported oiling pivot bearings, the seventh, having 90% ball bearings, did not mention practice in regard to oiling pivots.

Five companies use G.E. meter jewel oil and one company uses Nye's watch oil.

Two companies reported longer life for oiled bearings, the remainder had no comparative data.

3. Use of Ball Bearing in All Types of Meter

Five companies favored standardization on the ball bearing for all meters. Two wished to obtain further data on the new pivot type bearings.

4. Non-Corroding Steel Balls

Five companies had no opinion on the non-corroding steel balls which are being offered. Two considered a suitable, hard non-corroding ball would be desirable but questioned materials being offered.

5. New Meter Bearings

Two companies examine new meter bearings and one is considering the adoption of such a practice.

6. Lower Bearings—Line and Shop Tests

Two companies replace all bearings parts when meters are tested, the parts being microscopically examined in shop. The remainder examine and clean at the time of test and replace defective parts.

7. Effect of Outdoor Metering on Bearing Performance

Very little information was available on this subject. One company having had long experience with meters outside reported that, in general, bearing replacements were higher than for meters installed inside.

8. Examination of Replacement Parts

Four companies do not examine replacement parts. One examines parts but finds rejects very low. One examines microscopically only when source of supply is changed and another discontinued the practice because the percentage of rejects was extremely small.

9. Synthetic vs. Natural Sapphires

Four companies purchase synthetic sapphires for replacement, two companies natural sapphires, and one company about 50% of each, but favors the synthetic jewl.

10. Protection of Bearing Parts Before and During Installation

All companies take precautions to prevent handling of pivots and balls. Six provide protective containers or capsules for all bearing parts. One reports using a ball dispenser.

Electrical Equipment Committee—Operation, Maintenance*

Sub-Committee Report

By J. C. HENKLE
Portland General Electric Co.

AT THE time this Subcommittee was formed a study of apparatus failures with particular reference to bushing troubles was suggested. A. E. Frey, Pacific Power & Light, has covered this subject.

Acting on the suggestion that the practice of member companies with regard to maintenance and reconditioning of equipment be surveyed, a questionnaire was sent each member of the Subcommittee, and ten replies were received. The following is a condensed report of these.

Organization

All reported combination crews, although some have small maintenance crews at various plants. In most cases the fluctuating work caused by construction superimposed on the maintenance work is taken care of by employing additional men to do the construction. Since unemployment compensation has become operative in Oregon, some attention should be paid to seasonal operation. It may be more economical in the long run to vary the maintenance program using such men on short construction jobs, and then make up on repairs when construction is light.

Most companies reporting indicate no night crews, and any work done at night is at overtime rate. One or two companies, however, report that some of the regular maintenance work is done by night crews at straight time rates, because of the difficulty in clearing certain lines and equipment except after midnight, or on Sundays and holidays. One company reports considerable work done in 1937 by a night crew working on shifts of four weeks' duration. The employees, through their local union, requested that this shift be for two weeks instead of four weeks, which was agreeable to the company. Local conditions for each company will govern the advisability of having a regular night crew on duty.

Bearing Inspection and Maintenance

All companies reported a more or less regular program of bearing inspection and maintenance, though the period between inspections varied greatly, ranging from one month to several years. In most cases large generators and machines are equipped with thermometers or temperature alarms which might be classed as continuous attention, but for the type of machine that is not so equipped the period used most universally is one year. In other words, each year the bearings of all rotating apparatus of any considerable size is inspected, cleaned and repaired if necessary. This class of work is somewhat out of the electrician's field and most companies employ men who are especially trained in this class of work, or borrow machinists from other departments.

The selection of the type and quality of oil varies greatly with the companies reporting. A few report that laboratory analyses aid in determining the grade and quality of oil, but most find that past experience with the cut and try method is still effective. Some companies report that oil removed from bearings is cleaned, filtered and reused, though this practice is not general. Companies having special bearing maintenance crews say that other machine maintenance is done by such crews.

Electrical Machinery Tests

With one or two exceptions all companies report periodic tests on electrical machinery, but methods vary considerably. The value of periodic tests lies in the fact that when insulation deteriorates, it can be noted from the succeeding tests and many times burn outs can be avoided by repairing damage to insulation before failure occurs. One company reports that the life of generator windings has been prolonged by several years by reversing the windings, that is, making the terminal coils into the "Y" point and using the "Y" point at terminal coils. This treatment is used where honeycombing of the slot insulation is caused by corona.

Serious trouble has been avoided in d.c. machines when insulation values have declined to a point where it becomes necessary to take a machine out of service for cleaning and repairs.

All reports indicate that most tests are made with a megger at regular intervals, generally one year.

Insulator Tests

Of all the companies circularized, there were more reporting no regular test plan than those who do. Those companies who report routine tests show a period ranging from one to several years. A few companies report that bus insulators are tested. It would seem that the manufacturers have done a pretty good job, and that little trouble is experienced from insulator failures. The use of hot sticks is growing in favor and no doubt will supplant the megger in the field.

Cables in stations and substations are considered station equipment to the first manhole or cable terminal if run overhead, yet in the majority of cases maintenance of these cables is made by

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the underground department. This is no doubt due to the fact that this department is better organized to do this work. One company reports that station cables are tested by the station tester, but that repair work is done by the underground department. This plan has given excellent results.

Distribution Transformer Tests

The method of testing distribution transformers is substantially the same by all companies reporting. This is carried on over the winter peak and is usually done with split-core transformers, using both indicating and recording instruments. Several companies report the use of thermal type demand meters with great success.

There is a wide variance in the per cent load permitted on a transformer before replacing. The minimum reported was 100 per cent load, and the maximum 225 per cent. There are so many factors to be considered in this problem that no definite figure can be established. The type of load served, voltage conditions, duration of peak load, are some of the things which go to determine the policy of transformer loading.

Transformer Repairs

Methods employed in transformer repairs vary considerably with the different companies. When transformers are removed from service practically all companies report that the transformers are reconditioned before being replaced in service. This usually consists of a thorough cleaning, replacement of leads and bushings, when required, and filtering of the oil. At the same time connections are checked, gaskets, oil gauges, plugs, etc., are examined.

When transformers are burned out, the procedure is not necessarily the same. Some companies send small sizes to the respective manufacturers' service shops for repairs; others purchase the coils from the manufacturers and replace them in their own shops. Others rewind their own coils, and still others send the small sizes out to repair shops under private management.

When large size transformers are repaired, some companies rewind the coil in their own shops, while others purchase complete windings and assemble them. The methods used in this connection are usually a reflection of the facilities for carrying on this work, together with the experience of the shop personnel.

Oil-Filled Equipment

The matter of treating oil is about the same for all companies reporting. This work is done by either centrifuges or filters, or a combination of both. The time between treatments varies somewhat running from six months to two or three years. The average time is about one year.

One company reports the successful use of a filtering outfit mounted on a one-ton truck with a transformer which may be connected 24-66 or 11 KV. This makes a very convenient outfit for use at remote stations where the supply voltage may be any of those mentioned.

Another company reports the use of a special oil treating machine which employs steam heat, vacuum and Fuller's earth treatment for oil from burned out transformers. This is particularly effective in restoring original color to oil and removing odors.

Oil Circuit Breakers

Most of the responses indicate that the practice of weekly testing of oil circuit breakers is followed quite generally. This becomes a routine matter and certainly has done much to insure proper operation of breakers when they are called upon for automatic operation. After a breaker has remained in a closed position for weeks, or possibly months, without operation it may fail to operate when most needed.

Maintenance of breakers is also a matter of routine and for most companies this is done annually. At this time the whole mechanism is checked, oil changed and contacts checked and adjusted if necessary. This work is carried on even though the breakers may not have operated automatically since last overhaul.

Where breakers are subjected to unusually severe duty by reason of short circuit near the stations the breakers may throw oil, bulge tanks, or show other signs of distress. It is the usual practice to overhaul such breakers immediately after operation without waiting for annual inspection.

Bushing Tests

None of the replies received indicated a regular program of bushing tests. A few companies made tests both by power factor method and radio interference, but the results obtained were by no means conclusive. Last year when the committee met in Portland considerable interest was shown in the power factor method, one of the principal objections being its cost to the companies.

One company reported a series of tests by both power factor method and radio interference methods in which certain bushings shown to be O.K. by power factor method developed trouble from radio interference. It appears that there is room for further study and report on this question of bushing maintenance. Most of the companies have experienced severe service interruptions caused by bushing failures and if a not too costly method of testing can be perfected, it will be welcomed by all operators.

Safety Features

There were not many reports showing any new applications of safety features. There seems to be a growing use of Neon test sticks for use by operators and repair men to determine if circuits are energized. All companies have substantially the same routine methods for clearing lines for repairmen. Companies having series lighting circuits have no doubt experienced difficulty when these circuits become crossed with high voltage circuits. In such cases the ordinary test for open circuit or grounds becomes very hazardous, but by using a neon tube in connection with the regular test circuits, this hazard may be eliminated.

Reconstruction of Equipment

One company reports modernizing Kelman and Pacific Electric breakers by adding expulsion type contacts which have prevented oil throwing, speeded up time of rupturing arc and increased capacity under short circuit conditions. DeIon Grids have been added to Westinghouse breakers with similar results.

Another company reports that seven air blast transformers, 735-KW each, were changed from 20,000-volt primary to 12,000 volts, by paralleling the two halves of the primary winding and adding a coil to each half. The low voltage winding of a 12-phase rectifier transformer was altered and reconnected for 6-phase use. The good parts of 3-150-kva., 3-phase transformers were utilized to make one good transformer. Also the winding of a 1500-kva. motor was changed from double circuit Star to single circuit Delta.

Another company reports that constant current transformers formerly used with 4-amp. magnetite arc lamps were rewound for use with 6.6-amp. incandescent lamps. A 100-kva. transformer was rebuilt from 57,000-volt, water-cooled type to self-cooled, and the primary voltage changed for 11,000-volt operation. Several transformers were reconnected from Delta to Star on secondary side for use on 4100-volt service.

Equipment Failures

A 73-kv. oil circuit breaker failed due to over duty. A new breaker was already tested and set up ready to move into position to replace this breaker when a short circuit occurred which wrecked the breaker. Two tanks were blown loose and the castings, housing and tripping mechanism were torn loose from frame.

A 2,250-kva. generator failed from a breakdown to ground, presumably caused by lightning.

A 17,500-kva. generator failed, breakdown to ground caused by loose coils and wedges.

A 1,000-kva., 110-kv., outdoor transformer failed, transmitting oil fire to adjacent transformer.

A 110-kv. indoor oil circuit breaker failed, caused by porcelain bushing shell on inside of breaker tank flashing over through oil from bushing terminal to upper ground shield. The resulting explosion and fire did considerable damage to adjacent bushings and to overhead high tension bus work.

A 110-kv., 1,500-kva. transformer, low tension bushing shattered due to lightning.

A 1,250-kva., 275-volt d.c. generator, failed due to defective band wire. Winding was destroyed. Complete winding had to be reinsulated and rotor iron had to be restacked.

Two generator windings failed due to lightning. These machines had been damaged several times and the result of disturbing the coils to make replacement weakened the insulation to such an extent that subsequent failure occurred during similar lightning storms.

Another generator, 3,750-kva., was burned out during lightning storm. Coils were badly damaged as fire could not be put out until end shields were removed.

Two 2,300-volt, 5,000-kva. generators failed during lightning storm. One machine was completely rewound and laminations restacked. The other machine had to have 50 per cent of laminations removed and 20 new coils.

A compound filled bushing on a 73-kv. breaker failed and the resulting explosion seriously damaged four other bushings. All were replaced with oil filled type.

Several other generators were reported as failing due to lightning and lines grounding, repairs varying from a few coils to complete rewinding.

A 3,000-kva. generator burned out due to deterioration of insulation probably caused by corona. All coils had to be reinsulated.

Most companies report various small transformers burnt out by lightning and several companies report bushing failures.

From the reports presented herewith, it appears there is considerable trouble experienced with terminal bushings and as yet no uniform methods of testing bushings has been developed. This subject certainly merits further consideration. It is also apparent that an increasing amount of trouble is being caused by lightning, which might be made the subject of further study.

Electrical Equipment Committee — Apparatus, Design*

Unit-Type Substations

By JOHN BANKUS
Portland General Electric Co.

AT THE 1932 meeting of this Association, F. M. Lewis and A. Shipek presented an excellent paper entitled "An Economical Design of a Small Outdoor Substation." The authors stated that the designs contained in their paper were intended for serving territories of low load density and were limited to a maximum capacity of 1,500 kva. The design as presented was adapted to the installation of standard reclosing and regulating equipments.

Since this paper was presented, the electrical manufacturers have developed a single unit type of substation wherein the main power transformer, regulating equipment, feeder reclosing equipment, protective equipment and metering equipment are all contained in a single factory-assembled unit.

It is the purpose of this paper briefly to describe this new type of substation unit; to show how it compares in cost with the more conventional type of substation; to point out some of its advantages, and to outline briefly what is believed to be its field of application.

Description

Factory-assembled substation units are available in more or less standardized form for capacities ranging from 500 to 3,000 kva., and for primary voltages within the range of 11,000 to 34,500 volts. The distribution voltage may be 2,400 volts, 4,160 volts star, or 7,200 volts delta.

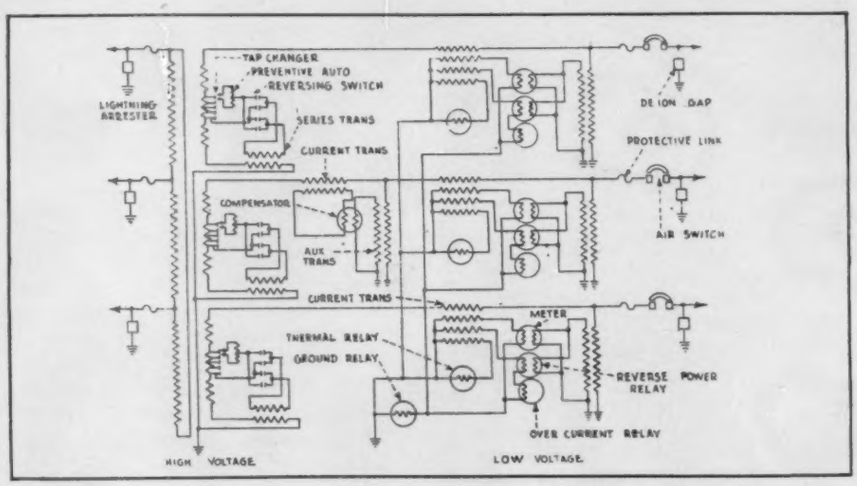

Fig. 1—Schematic diagram for factory assembled unit-type substation

The units may be obtained for either 5 per cent plus and minus or 10 per cent plus and minus regulation. Or if desired, other combinations of buck and boost within the above total ranges may be used. For example, in the unit having a total regulation range of 10 per cent in eight 1¼ steps, the connections might be arranged for 2½ per cent above and 7½ per cent below normal high voltage potential.

Fig. 1 is a schematic diagram which shows the connections of the main apparatus and associated control and protective equipment for the factory-assembled unit type substation.

The three-phase power transformer would normally be furnished with four 2½ per cent, full-capacity voltage-reduction taps in the high-tension winding. The tap changing under load equipment consists of a preventive auto transformer switched by a tap changer along the taps in the middle of the low-tension winding. In some cases the tap changing under load equipment, is installed in the high-tension winding. Approximately 30 per cent overload capacity may be obtained by adding automatically controlled air blast equipment.

The high-tension side of the transformer is provided with protective links of sufficient interrupting capacity to provide back-up protection, and to disconnect the transformer from the source of supply in case of an internal fault.

The low voltage switch is of the three-pole, solenoid-operated type, and may be either an air switch or oil switch depending on distribution voltage and interrupting capacity requirements.

Three protective fuse links are connected in the low-tension circuit between the secondary switch and the low-voltage terminal board. These are for back-up protection and will operate in case of failure of the other protective equipment.

The potential and auxiliary transformers are protected by individual protective links which will remove them from the circuit in case of an internal fault. Both high and low tension sides

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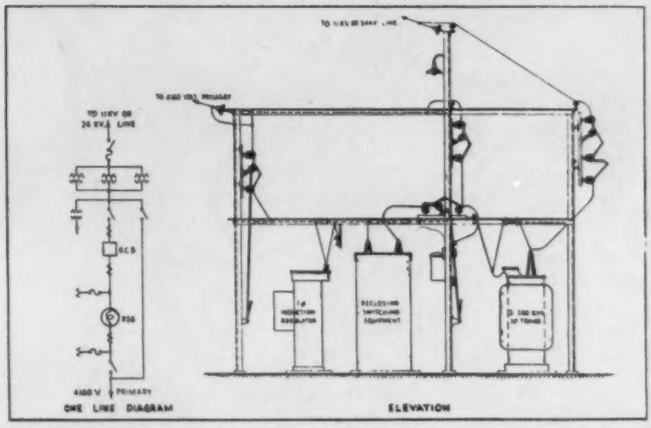


Fig. 2—(left) Arrangement for 600 to 1,500-kva. substation

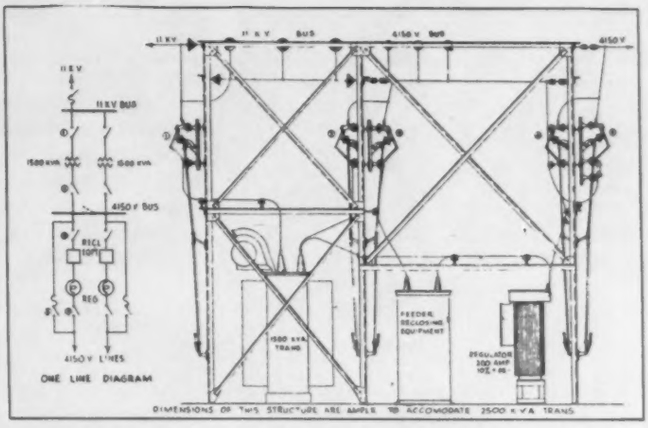


Fig. 3—(right) Arrangement for 3,000-kva. substation with two 4,150-volt feeders

of the unit are equipped with lightning arresters. The operating motor and control equipment are designed for use on a 120-volt, single-phase circuit.

The low-tension switch may be tripped by any of the following relays:

(1) Over current phase relays
(2) Ground relay
(3) Reverse-power relay
(4) Thermal relays

The current transformers are of the triple secondary type. One secondary winding is used for metering, the second for phase-overload relays and reverse power relay, and the third for thermal relays.

Cost Comparison

The cost comparison shown in Table I is on the basis of 11,000-4,160-Y-volt transformation, and 10 per cent plus and minus voltage regulation. The conventional substation for capacities from 600 to 1,500 kva. inclusive is of the single feeder type with switching arrangement as shown in Fig. 2. The 3,000 kva. substation includes two 1,500 kva., three-phase transformers and two 4,160-volt feeders arranged as shown in Fig. 3.

Table I—Costs

(Cost per kva. installed exclusive of property, clearing, grading and landscaping)

Substation Capacity in kva.	Conventional Design	Factory Assembled Unit
600	$18.50	
1000	14.00	$13.00
1500	11.50	9.50
3000	10.50	

Advantages

1. Require less ground space. The possible saving in land requirements will depend largely on location. In some cases it may result in material reduction in capital charges, taxes and landscaping.
2. By installing substation capacity in relatively small units, it is possible to locate the step-down capacity much closer to the load centers than would be possible where large substations are used. This saves feeder copper, and improves voltage regulation.
3. Units have 100% salvage value, and can readily be removed if the load center should change. This feature also makes them well adapted for serving temporary loads.
4. The factory-assembled unit results in a lower installation cost, since it is only necessary to install the unit at a suitable location, and connect the incoming line and outgoing feeder to the unit.
5. In the factory-assembled unit, the responsibility for application and operation is fixed with one manufacturer. This should result in better coordination of design.
6. The elimination of exposed connections between several pieces of apparatus should assure a higher degree of service reliability. This should also make it safer for operating personnel.
7. The coordinated protection scheme incorporated in the factory-assembled unit should allow it to carry greater useful loads with full protection against damage.
8. When these unit type substations become standardized, fewer renewal parts should be required.

Disadvantages

1. The operation of one piece of apparatus is entirely dependent on the proper functioning of the other parts of the unit. Failure of any one small part may throw the entire station out of service.

In the type of factory-assembled unit considered in this paper, the transformer is 3-phase, and the design includes no provision for bypassing the regulator and reclosing equipment. In the conventional design where single-phase transformers are connected delta-delta, it is possible to cut out one transformer, and operate the remaining transformers at reduced capacity in open delta. This, of course, would not be possible where the distribution voltage is star.

It is undoubtedly true that trouble is most likely to occur in the regulating and tap-changing equipment. In the conventional design, provision can easily be made, and is ordinarily incorporated in the substation layout, for bypassing the regulator and reclosing equipments. If trouble develops in the integral-type tap changer, it becomes necessary to shut down the entire substation.

2. Having the regulator tied in directly with the transformer entails inflexibility. This is particularly true where the regulation requirements of several feeders are materially different.
3. It is also probably true that the servicing of the factory-assembled unit will be somewhat more complicated on account of the compactness of design.
4. The saving in feeder copper, resulting from locating the unit type substations near the load centers, is partially offset by the increase in investment which will be required for subtransmission.

Field of Application

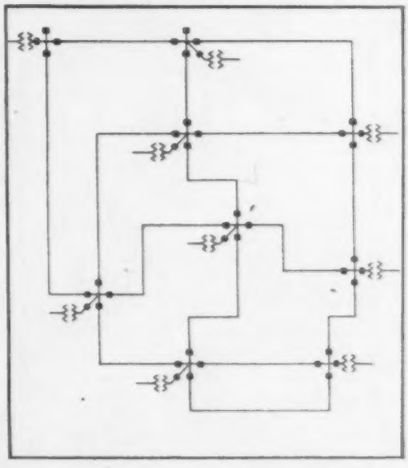
The factory-assembled type substations are adapted for supplying radial type feeders where the layout of the distribution systems is such that the feeders served may be connected to adjacent feeders under emergency conditions. With this arrangement, it is possible to disconnect the substation unit without affecting service at such times as it is necessary to inspect or do any work on the substation equipment. A field of application for such installations would be for taking care of load growth between existing substations, particularly where long distribution feeders would be required, if such loads were served directly from existing substations.

A substation unit, which has the regulating equipment integral with the step-down transformers, would appear to be somewhat less reliable than the conventional design for serving isolated loads.

The factory-assembled units would appear to be especially adapted for serving the primary network type of distribution such as is illustrated in Fig. 4.

A proper appraisal will not be obtained if consideration is given only to substation costs. It is necessary that we consider the total costs involved in

Fig. 4—Arrangement of typical primary network



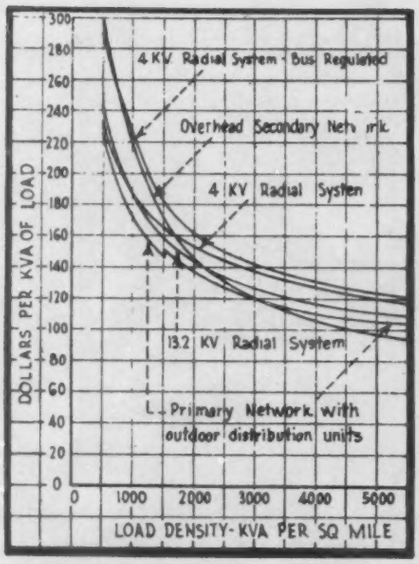


Fig. 5—Sub-transmission and 4-kv. circuits open wire

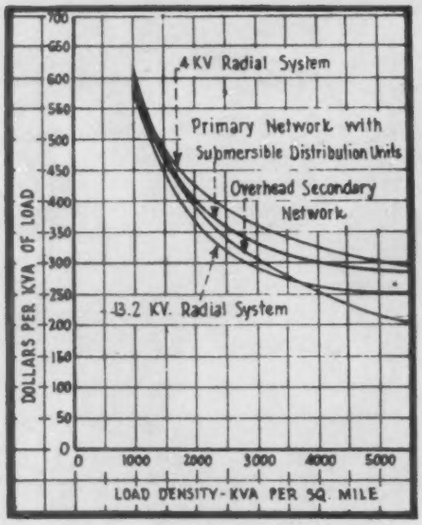


Fig. 6—Sub-transmission and 4-kv. circuits underground cable

serving a given area. This is true because the type of distribution system is also a factor. The economies of various types of distribution will be affected by the load densities served.

John S. Parsons and Leonard M. Olmsted, of Westinghouse, have made cost estimates for various types of distribution systems for serving a uniform load in a 16-sq.-mi. area growing from 8,000 to 85,600 kva.—that is, from 500 to 5,350 kva. per sq. mi.—at the rate of 10 per cent per year. The cost estimates cover the total system investment within the 4-mi. square, that is, subtransmission, substation and distribution up to, but not including, the consumers' services and meters.

Parsons and Olmstead made a number of assumptions relative to the use of open wire and cable for subtransmission and 4-kv. distribution circuits. These assumptions are given in an article in the May 7, 1932, issue of *Electrical World* and also in a recent Westinghouse bulletin covering unit substations.

Figs. 5 and 6 showing the cost per kva. of load for various load densities, have been taken from the bulletin. Fig. 5 assumes the subtransmission and 4-kv. circuits open wire. Fig. 6 assumes the subtransmission and 4-kv. circuits underground cable. These figures, therefore, represent minimum and maximum values.

It is of interest to note that from 500 to 2,800 kva. per sq. mi. (with subtransmission and 4-kv. circuits open wire as shown in Fig. 5) the primary network using unit-type substations is the least expensive system.

In conclusion, therefore, it should be pointed out that careful consideration should be given to the application of unit-type substations when plans are being made for increasing the capacity of existing distribution systems.

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Discussion

J. Hellenthal pointed out that the lower installation cost in the field would be offset by the cost of assembly at the factory, which would appear in the price of the equipment. As for the manufacturers' responsibility for the equipment, this generally extends for only one year.

He felt if the cost analysis in the paper had been carried far enough, to units of large enough capacities, the results would be about as shown in the Lewis and Shipek paper.

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Switchgear

REPRESENTATIVES of four manufacturing companies presented developments in circuit breakers and disconnecting switches. A summary follows:

J. F. Spease, General Electric, showed pictures of installations of metal-clad switchgear in voltages up to 15 kv. He pointed to neat appearance, compactness, and convenience in operation and maintenance. With the breakers in the back, the busses in the top and control

Table I—Wiring

	Standard R.C.																Special R.C.			
Conduit Size O.D. / I.D. / Used D.	4 in. 4.500 4.026				3 in. 3.500 3.068				2 in. 2.375 2.067				1 in. 1.315 1.049				1 in. 1.315 1.049			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Wire Size	1000	1000	750	1000	500	600	400	500	3/0	4/0	2/0	3/0	6	6	8	6	4	2	6	4
Amp. Capacity	650	650	525	650	400	450	325	400	175	225	150	175	50	50	35	50	70	90	50	70
Kva. Capacity	156	156	139	234	96	108	117	144	42	54	54	63	12.0	12.0	12.6	18.0	16.8	21.6	18.0	25.2
Kva. Increase over "A" %.	—	0	21	50	—	13	22	50	—	29	29	50	—	0	5	50	—	13	7	50
Kva Incr. over Corres. RC Wire %																				
Kva Incr. over "A" RC Wire																	40	80	43	50
Costs of Material per 100 Ft.																	40	80	50	110
Wire	$178	178	182	227	90	104	97	117	34.80	41.00	40.00	44.40	7.50	7.50	8.00	9.90	36.90	35.60	43.00	39.30
Conduit	81	81	81	81	56	56	56	56	27.30	27.30	27.30	27.30	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50
Total	259	259	263	308	146	160	153	173	62.10	68.30	67.30	71.70	20.00	20.00	20.50	22.40	49.40	48.10	55.50	51.80
100' Wire Cost per Kva.	$1.08	1.08	.97	.97	.93	.96	.83	.81	.85	.75	.74	.71	.63	.63	.63	.55	2.40	1.65	2.40	1.56
100' Wire and Conduit Cost per Kva.	1.76	1.76	1.39	1.32	1.52	1.48	1.31	1.20	1.48	1.27	1.25	1.14	1.67	1.67	1.13	1.30	2.93	2.23	3.08	2.05
100' Wire Cost Bare Neutral only				48.60				27.40				9.60				2.40				2.40
Kva Increase (D-A)				78				48				21				6				8.4
100' Bare Neutral Cost per Kva Incr.				.68				.57				.46				.40				.29

A. Three rubber covered wires in conduit.
B. One RC wire removed and two bare neutral conductors added.
C. Three RC wires removed and replaced with four smaller RC wires.
D. Three RC wires removed. and pulled in again along with two bare neutrals.

from the front, the factory built job makes for low installation cost, and places responsibility on the manufacturer for satisfactory operation.

V. B. Wilfley, Westinghouse, told of the improvements made in circuit interrupters of the De-ion grid type by which the arcing time for breakers of small voltages has been materially reduced. De-ion grids are now available for application to all old Westinghouse breakers, 15 kv. and above, manufactured since 1921.

C. T. Hurd, Allis Chalmers, showed pictures and described the air circuit breakers offered by his company, emphasizing speed of operation and reduction of costs. The fundamental design is based on the Brown Boveri practice used in Europe for a number of years. He showed both the vertical and horizontal type, with and without cubicles.

A. C. Schwager, Pacific Electric Mfg., emphasized the effect of expulsion arc rupturing devices on the performance of all circuit breakers from 7.5 to 230 kv. He showed pictures of the motor wound torsion spring that actuates interrupting and re-closing mechanism capable of providing for two openings and one re-closure without the necessity of rewinding by motor. As to disconnecting switches, he showed slides illustrating the ice tests on the 115-kv., 3-pole switches installed at Bonneville which operated with an effort of less than 75 lb. on the operating handle when covered with 1½ in. of ice.

Code Committee*

Economics of Wiring Design†

By S. B. CLARK
Northwestern Electric Co.

ADEQUACY in wiring has held a major place in the discussions on wiring for some time but has centered chiefly around residence wiring. Selling campaigns on the Better Light Better Sight program and campaigns on household appliances have even found recognition in national and municipal code requirements.

The effort of these campaigns has also had its effects on wiring in store and office buildings. From a cost standpoint the problem of increase in conductor capacity is not as simple in the modern fireproof constructed office building as in the family dwelling. Stores and office buildings have greater load factors and require a correspondingly greater expense for additional raceway and conductor capacity from the source of supply to the distribution centers.

An inexpensive feasible method of obtaining additional feeder branch and circuit capacity, although contrary to existing code, is available. The additional increase in per cent or kva. in conductor capacity over the ordinary 3-wire, single-phase lighting distribution depends upon the factors of the original installation, but in no case less than a 50 per cent increase in kva., and in some instances as high as 200 per cent, can be had at a low cost.

Assuming the ordinary 3-wire lighting distribution, which can be assumed to cover at least 90 per cent of store and office buildings now occupied, four examples of conduit wire raceways have been taken with the usual wire assembly, and tabulated as A, B, C and D. (See Table I.)

A is the usual 3-wire 120/240-volt circuit,
B is a possible but not probable condition and referred to only for comparison purposes,
C is a conversion from the usual 3-wire distribution to 4-wire, 120/208-volt circuit,
D is an assembly using a bare or covered neutral.

In all four cases, space factor as allowed by the N.E.C. has been used, which, in a re-wiring program, in many instances can be increased without detrimental effects to the installation.

Referring to Table I and using a 3-in. conduit as an example, in Column A, we find, by removing the supposedly existing maximum conductor sizes, Code insulated wires of 500,000 circ. mil, and replacing the conductors with 400,000 circ. mil wire assembly, Column C, we have a 22 per cent kva. increase over the original installation and have decreased the involved material cost of 100 ft. of conduit and wire per kva. from $1.52 to $1.31.

Referring again to A as an assumed original installation and with the labor only of removing and re-pulling and converting to a 4-wire circuit using a bare conductor as a neutral, a gain of 50 per cent in kva. capacity is obtained, and with a decrease in kva. material cost per 100 ft. of conduit and wire from $1.52 to $1.20. (No prices being available on bare conductor, Code rubber covered wire prices were used.)

Let us consider the possibilities of circuit increase by using the above assemblies and a new development of insulated wire, recently placed upon the market, with a thin insulation without braid, which materially decreases conductor diameter. Here the material cost at present is high, but considering the per cent of kva. increase over customary installations, and the extreme high labor cost of new wire raceways in existing modern fireproof buildings the material cost is still low.

Referring to the last tabulation of 1-in. conduit, and where the space factor is based on the decreased diameters of this newer insulated conductor, note that the kva. increase over assemblies using Code wire with braid is considerable for assemblies A, B and C, but the assembly used for D shows an increase of 110 per cent.

With the possible increase of space factor over that now allowed by Code and due to qualities possessed by the new type of wire over our standard Code wire, an increase of 170 per cent can be obtained.

Apparently, from conferences held with the management of Class A and B buildings, an approximate increase of 100 per cent in existing lighting facilities is most commonly desired. With our assistance considerable additional load can be obtained in the modern store and office buildings at a reasonable cost to the building owners.

H. A. Patton—The problem of making insulated wires with smaller over-all diameters is a manufacturer's problem. As for the bare neutral, I believe this wiring system has merit and is coming. Some points of difference exist in the interpretation of provisions of the National Electrical Code as it is being enforced throughout the Northwest states. Utility companies should seek uniform interpretation by administrative bodies throughout the territory.

Dr. Robert J. Wiseman—The manufacturers have assisted Underwriters Laboratories in tabulating the tests for loading, current carrying capacity and insulation of conductors, spending considerable money to investigate this subject. We are now preparing tables for carrying capacities under varying conditions and trying to determine how many conductors can be pulled into different sized conduit. We have also developed different types of insulation. Using higher temperature compound,

† Presented in discussion of L. W. Going's paper, see contents page.

* M. T. Crawford, Puget Sound Power & Light Co., Chairman; The California Oregon Power Co., S. M. Bullis; Eastern Oregon Light & Power Co., H. J. King; Grays Harbor Railway & Light Co., W. C. Kidder; Idaho Power Co., H. M. Jones; Mountain States Power Co., G. McClellan; Northwestern Electric Co., S. B. Clark; Oregon Insurance Rating Bureau, Fred D. Weber; Pacific Power & Light Co., R. J. Davidson; Portland General Electric Co., F. H. Murphy; Utah Power & Light Co., W. J. McMinn; Washington Gas & Electric Co., R. Protheroe; Washington Surveying & Rating Bureau, H. A. Patton; The Washington Water Power Co., L. R. Gamble; West Coast Power Co., Henry Berk; and L. W. Going, Chief Electrical Inspector of Portland, and M. P. Hotelling, State Electrical Inspector of Washington.

we can get more capacity through the same size wire.

A. B. Campbell—With due respect to Mr. Going's excellent presentation, I would like to take exception to his reference to "the attack on the Code by the utility industry." The utility industry endorses the Code and participates in its making. Liberals among the industry advocate keeping the Code in step with invention and improvement in design of materials and wiring systems—in other words, in step with progress. The electric light and power industry is not in favor of lowering safety standards or requirements, though they are in favor of taking some of the unsafe things now permitted out of the Code.

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N. F. P. A. Report

By M. T. CRAWFORD
Puget Sound Power & Light Co.,
Association Representative

ONE IMPORTANT activity of the Code Committee concerns the National Electrical Code. This was completely revised by the Electrical Committee, N.F.P.A., at the Atlantic City meeting in March 1937, as reported at last year's meeting of this section. Indications are that there will not be another formal meeting of the Electrical Committee until 1939 when the bi-annual revision of the code will come up for consideration.

Since the 1937 edition of the code was issued, there has been one minor revision by letter ballot. This was known as Tentative Interim Amendment No. 23 and was in connection with Chapter 10. Section 103002, Paragraph d, on the subject of braid for rubber covered wires, was changed to read as follows:

"d. Fibrous Covering. Single conductor type R 600-volt wire, unless provided with a lead sheath, shall have a fibrous covering so treated as to be flame-retardant and moisture-resistant."

Section 103341, Paragraph "a" relating to armoured cable had its last sentence changed to read as follows:

"The individual conductors, except those of lead cable, shall have a fibrous covering for their entire length so treated as to be flame-retardant and moisture-resistant."

The electric light and power group representatives on the Electrical Committee held several meetings but on account of the expense entailed, your representative did not feel justified in making the trip to New York for attendance. At a meeting in December there was considerable discussion in regard to the best position to take in connection with the current revision of the National Electrical Safety Code of the U. S. Bureau of Standards. A considerable amount of correspondence was carried on during the year on this subject and on one occasion your Code Committee Chairman circularized all member companies to obtain an expression of their opinion in regard to a number of proposed changes. The replies were consolidated and forwarded for the advice of the Electric Light and Power Group on the sectional committee revising the N.E.S.C.

Considerable discussion by correspondence is in progress in connection with the proposal to make the use of non-tamperable fuses mandatory in the N.E.C. Many utility representatives do not feel that these fuses in their present form will accomplish the objective.

A special technical subcommittee on transformer vaults was appointed by A. R. Small, chairman of the Electrical Committee, to study present transformer vault practice insofar as fire and explosion hazard is concerned. An extensive survey of the history of transformer vault operation and explosions was conducted and reported on, and a number of changes are being proposed in the code amplifying the requirements for ventilation and other features.

Your chairman is a member and has taken an active part in numerous meetings of the International Assn. of Electrical Inspectors. It is felt that the utility engineers and the inspectors have similar objectives in mind, and that there should be a close bond between them. It is recommended that member company engineers take an active interest in the work of the inspectors in their territory, as it will result in ironing out minor differences at the source. The utility and inspector groups form a large block in the voting strength of the Electrical Committee. By working together these two groups can accomplish much.

A special request is made that you report to your chairman matters in connection with any of the various codes which are in need of revision, in order that steps may be taken to get the necessary changes made. A number of situations have arisen during the year in which there were differences of opinion as to the proper interpretation of the code, between members and the authorities enforcing the code, and assistance was given resulting in amicable agreements. In one case expert testimony was given in litigation where a member company was sued for a very large sum, alleging responsibilitity for a fire which destroyed a customer's plant. It was clearly shown that the company's construction was adequate but that the customer's installation failed to conform with the code. This showing contributed measurably toward the court's decision dsimissing the case.

Safety Code Revisions

By A. B. CAMPBELL
Edison Electric Institute

THE FOURTH edition of the National Electrical Safety Code has been in effect since 1926. We have tried to revise it, particularly as to ice and wind loading, and have collected considerable data on weather conditions, but up until recently have not got together on this revision. We have now substituted a series of empirical formulas to specify climatic loadings, a method that seems to be suitable.

The committee now organized to revise the Code represents 22 organizations. From this committee, technical sub-committees have been organized on each part of the Code, except Part IV on working rules.

The most controversial part of the Code seems to be in Part II on sags and tensions, clearances, climatic loading, and longitudinal strength of power lines at crossings. As to copper wire, Type A and Type A.C.S.R., we have very complete data on just where the wire will sag under all conditions of tension, temperature, ice loading, etc. The Aluminum Co. is setting up the same data for aluminum.

Part III will deal with customers' wiring not covered by the N.E.C. electric fences, electrical installations in gravel pits and strip mines, outdoor motors on farms and similar portable wiring and equipment.

The revision of the N.E.S.C. was undertaken last May and intended to be completed this spring, but actually it may be considerably later before the revision is completed. We should not hurry this, but should give it plenty of consideration, since it may be several years before we are able to revise it again.

Accident prevention is becoming a very important subject with our industry nationally, and the Northwest committee is to be commended for the work it is doing. The industry generally has had several years of deferred maintenance and now has in its organization many new men. This has tended to increase accidents and make accident prevention work more important. We have found most of our accidents in transmission and distribution departments of the business.

Farm electrification has made great progress in recent years, both within the private utility industry and by the R.E.A. The R.E.A. is now serving approximately 50,000 farms, and it is

finding it desirable to take up engineering and operating functions in addition to financing functions.

A new law with respect to lighting and marking structures that may be a hazard to aviation is receiving attention now in Congress. The 1934 law required the marking and lighting of structures over navigable streams. The new law provides for this not only over navigable streams but elsewhere. If it passes, it may prove very burdensome to the industry. As a matter of fact, most aviation accidents with power wires or poles would have happened in spite of marking or lighting.

The committee that has been studying the effect of grounding to water pipes has not completed its work. The only general conclusion that can be reached at the present time is that no good case has been made against grounding to water pipes.

Transmission and Distribution Committee*

Protecting Transformers

Discussion

(For location of article under discussion consult the index)

Corbett McLean—Northwestern Electric has experimented with fusing distribution transformers on the secondary side. The results so far look encouraging from the economy standpoint and the practice seems to merit further consideration. The company expects to continue with these experiments.

Henry Berk—West Coast Power has also experimented with secondary fusing. We also fuse the primary side to make it easy to change to a larger size transformer because we have so much of this to do. We have come to the point of recommending fusing of secondaries of all 1½-kva. transformers, and, in special cases, 3-kva. transformers.

In the future we will probably use on 6,900-volt delta primaries no smaller transformer than 3-kva.

●

Economics of Modern Distribution Design

Discussion

(For location of article under discussion consult the index)

Paul P. Ashworth—There is sometimes a tendency to plan too far into the future and to make these plans inflexible. There should be sufficient flexibility in the plan to permit changes made necessary by changing conditions. For instance, the commercial department may change its rate schedule and this may create new load on lines originally contemplated and upset the plan entirely. We have a common-neutral system, 11,000-volt, in one section, which is operating satisfactorily without giving undue trouble to the telephone system.

George I. Drennan—The demand for economy in distribution construction, which has led to longer spans and the use of untreated poles and other expedients to cheapen construction costs, has caused some of us safety engineers considerable concern. This is just a warning that there is a safety angle involved in this planning.

Henry Berk—West Coast Power has changed a number of lines from 6,900-volt delta to 11,000-volts Y, using the same transformers, and thereby increased the capacity 60 per cent at very little added cost.

L. R. Gamble—The use of untreated poles east of the mountains is false economy. They do not last in our soil. Several farmer lines are being built under Washington Water Power supervision and we insist on treated poles because we are fearful that the cooperatives that operate these lines will not properly maintain untreated poles by stubbing them at the proper time.

R. J. Davidson—Pacific Power & Light has also found untreated poles to be false economy in our territory east of the mountains.

Among the happenings that tend to upset long term distribution line plans are the construction of irrigation systems in country districts and street improvements in the towns.

E. F. Pearson—An example of plans being upset by the establishment of new rates is to be found in New Orleans where the filing of an air conditioning rate and the subsequent business taken on under it entirely upset the original plans for the underground system in that city.

M. T. Crawford—The progressive substation idea seems to be in line with good planning. The steps should be so organized that light equipment can be easily replaced for increased capacity and moved to new areas where the load is still light.

Judgment and mathematics are necessary in figuring the useful life of lines. Obsolesence enters into this and the determination of obsolesence is a matter of judgment.

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Transmission Construction

Discussion

(For location of article under discussion consult the index)

By C. H. HOGE
Puget Sound Power & Light Co.

THERE are several points in Mr. Gamble's paper that are of particular interest to me. Referring to the Montana Power Co.'s Flathead-Anaconda transmission line, I am impressed by the simplicity and ease in transposing the line conductors. While traveling in Montana last summer I noticed that transpositions were being made apparently without change in span lengths, on one H-structure, and without additional guying or the use of any dead ends or special hardware fittings for the insulator strings. It would be of interest to know how much more the transposition structures cost than the standard H-frame structures.

I am also interested in the method of attaching guys to poles in the same line. It is not clear to me just how this was done, unless it is the ordinary wrap-around method with guy strand through thimble guy and slack taken up by slipping guy on pole. No reference is made to plates under guy wrap on pole. Is there any slippage of guys on pole after loading was applied? For the last year or so Puget Sound Power & Light

*E. F. Pearson, Northwestern Electric Co., Chairman; R. J. Davidson, Pacific Power & Light Co., Vice-Chairman; Allis Chalmers Manufacturing Co., C. T. Hurd; B. C. Electric Railway Co., P. C. Gill; The California Oregon Power Co., R. S. Daniels; Eastern Oregon Light & Power Co., O. D. Lanning; General Electric Co., C. E. Canada; Graybar Electric Co., E. J. DesCamp; Grays Harbor Railway & Light Co., F. J. Robbins; Idaho Power Co., H. M. Jones; The Montana Power Co., H. S. Thane; Mountain States Power Co., Walter Smith; Northwestern Electric Co., Corbett McLean; Oregon State College, F. O. McMillan; Pacific Electric Manufacturing Co., C. H. Cutter; Portland General Electric Co., Gwynn Bishop, H. R. Wakeman; Puget Sound Power & Light Co., C. H. Hoge, E. R. Nigh; Thos. S. Wood Co., T. S. Wood; Utah Power & Light Co., D. L. Brundige, G. W. Westcott; Washington Gas & Electric Co., R. Protheroe; The Washington Water Power Co., Earl Baughn, L. R. Gamble; West Coast Power Co., C. P. Eliot; Westinghouse Electric & Manufacturing Co., V. B. Wilfley.

has been using 45-deg. thimble eye-bolts for guy attachments, and for heavier loading guy loops and saddles. I am wondering if this procedure was considered when the method of attaching guys to poles was discussed.

Oral Discussion

It was asked whether, in the case of the Chelan line, any guy trouble had been experienced on account of the crusted snow going off in the spring; and as to the tension on the long crossing span. Mr. Gamble stated that generally the guys were in places where the snow was not deep and no trouble had been experienced yet. Tension in the long span is 6,000 lb., about one-fourth the limit on that type of conductor.

●

Economics of Shunt Capacitors

By WALDO ENNS
and GWYNN E. BISHOP
Portland General Electric Co.

IT HAS long been known that a low power factor load with its attendant reactive component is detrimental to an electric system in three ways:

1. It causes excessive voltage drop.
2. It reduces the load carrying capacity in kilowatts.
3. It increases the losses in the entire circuit from the generator to the load.

At present, with distribution circuits becoming loaded to capacity, with more demands on the power system for better voltage regulation, and with decreasing rates, the problem of bettering service in the most economical manner has become extremely important.

Recently, with the development in manufacture and the reduction in cost of static capacitors, their possibility as a method of power factor correction has become more general.

Static capacitors have been used for years with economic benefits in special applications, in industrial plants having a low power factor motor load, in neon sign transformers and many other places. Much has been written of their increasing use on power system feeders for power factor correction and many examples given of money saved by their use. Most of these cases are somewhat special, and so it was decided to take a common distribution circuit, as nearly typical as possible, and see how capacitors could be used and how they would compare with other methods of increasing capacity.

In order to obtain what could be termed a typical distribution, feeder curves of kw., power factor and voltage were taken on a number of 2300-volt feeders. One of these feeders was then chosen as the one which capacitors would likely most benefit.

Such a feeder has No. 2/0 copper wire with an effective spacing of 4.1 ft. The maximum load is 816 kw. at 89 per cent power factor with a minimum load of 168 kw. at 57 per cent power factor. The line current at full load is 230 amp. The feeder is regulated by two 200-amp, induction type regulators having a regulation of plus or minus 10 per cent. The load center was assumed as being 1 mi. from the substation.

It was desired to relieve the overloaded condition of the regulator and provide for load growth in the most economical manner.

Three methods for doing this will be considered:

1. Using shunt capacitors.
2. Increasing the capacity of the regulator.
3. Increasing the voltage to 4,150 volts Y.

Adding a Shunt Capacitor

The voltage rise produced by the capacitor is independent of the load and depends only on the characteristics of the line as can be seen from the equation:

$$\% \text{ voltage rise} = \frac{(CKVA) \times d}{10(KV)^2}$$

Where x = ohms reactance per mile of line.
d = length of line in miles.
CKVA = condenser capacity.
KV = line kilovolts.

The net voltage drop or rise as the case may be at any point on a line to which shunt capacitors have been added is the difference between the voltage drop produced by load current and the voltage rise produced by the leading current due to the capacitors. Since the voltage rise produced at any point on a given distribution circuit by the capacitor current is nearly a constant under all conditions, care must be taken, when adding capacitors to a circuit, to see that the voltage at light loads is not excessive. The maximum operating benefits are obtained by correcting the power factor to unity at all times, but this is not possible unless some means of disconnecting the capacitor from the circuit at light loads is provided. With capacitors connected to the line permanently, the usual practice is to correct for the average reactive load.

The voltage regulation at the load center on the circuit chosen, with the loads as given and without regulators at the substation, is as follows:

Maximum load voltage drop in per cent	12.3%
Minimum load voltage drop in per cent	4.6%
Net regulation at load center	7.7%

With the induction regulator in the circuit connected for plus or minus 10 per cent regulaton, the maximum voltage regulation at the load center becomes 2.3 per cent without voltage boost at the substation bus. The possibility of reconnecting the regulator for plus or minus 5 per cent regulation and 400-amp. capacity was considered. With this connection the maximum regulation at the load center becomes 7.3 per cent without voltage boost at the bus. This is shown in Fig. 1.

The normal method is to regulate for zero regulation at some point on the line. In order to make this problem definite, it will be assumed that it is desired to hold zero regulation at the load center.

With the regulator connected for plus or minus 5 per cent regulation, the regulation at the load center becomes 7.3 per cent as stated above. If taps were available on the supply transformers, as they are in most cases, and if the voltage at the substation were boosted 5 per cent with plus or minus regulation, the regulation at the load center would become 2.3 per cent as shown on Fig. 2. This is more regulation that has been set up as desirable, and with any increase in load it would become greater.

For the purpose of this paper, it will be assumed that such taps are available and calculations will be made on this basis.

The mean reactive kva. for maximum and minimum loads on this feeder is approximately 330 so that a capacity of 330 kva. was assumed as being added to the circuit at the load center.

The voltage regulations at the load center without regulation at the bus, and with capacitors added, become:

Maximum load voltage drop	7.9%
Minimum load voltage drop	.2%
Net regulator at load center	7.7%

This is plotted in Fig. 3, and as might be expected, the regulation is not improved. However, it will be noted that the relative level of voltage at all points along the circuit is higher.

The effect of regulators being added to the circuit is also shown in Fig. 3. It will be seen that with the regulators connected for plus or minus 5 per cent regulation and the voltage boosted 5 per cent at the bus, the maximum voltage variation at the load center becomes zero.

The current at maximum load becomes 206 amp. as compared with 230 amp., and the regulator capacity has been increased from 200 to 400 amp. without exceeding the voltage regulation limit.

Since zero regulation at the load center is assumed as allowable with 5 per cent voltage boost at the substation, the maximum capacity of the circuit with 330 condensive kva. of shunt capa-

citors and regulators set for plus or minus 5 per cent regulation, on a voltage regulation basis, is 951 kw.

The same line without capacitors and on the basis of zero regulation at the load center, 5 per cent boost on the substation and regulators set for plus or minus 10 per cent regulation has a capacity of 709. This is limited by the 200-amp. current capacity of the regulators. Adding 330 condensive kva. of shunt capacity has therefore given a net gain of 242 kw. in the capacity of the line.

Increasing Regulator Size

It will be noted that one of the limiting features of the present line is the size of the induction regulators. One solution of the problem might be to replace the present regulators with regulators of a larger current capacity. Accordingly, calculations were made on the basis of installing new 300-amp., plus or minus 10 per cent induction regulators.

On the basis of a maximum regulation of zero at the load center with plus or minus 5 per cent boost at the substation, the line capacity with the larger regulators would become 992 kw. At 89 per cent p.f. the current for this load becomes approximately 280 amp., which is within the current limit of the regulators. The gain by this method would be 992 kw., 709 kw. or 283 kw.

It should be noted that with the above condition, the voltage between the bus and the load center becomes high. If load is to be taken off the line between these points, and taps are not available on the distribution transformer to compensate for this high voltage, such a scheme might not be feasible. However, in most cases of feeders on the Portland General Electric system, there is no load taken off between the load center and the bus, so that this objection would not apply.

Changing Line Voltage

By adding a third voltage regulator and changing the voltage of the line from 2,300 to 4,150 Y, and by keeping the regulation limit of zero to the load center, and with the regulators connected for plus or minus 10 per cent regulation and no boost at the substation transformer, the circuit capacity becomes 2,153 kw. at 89 per cent p.f. on a strictly voltage drop basis. However, at 89 per cent p.f this is equal to a current of 337 amp., which is more than the current carrying capacity of the 200-amp. regulators.

By reconnecting the regulators for plus or minus 5 per cent regulation and 400-amp. capacity and connecting the substation transformer for 5 per cent boost, the maximum load on a zero voltage regulation basis will become 2,150 kw., the same as it was above. The difference is that the regulators now have a capacity of 400 amp. and will carry the necessary current. The net gain in kw. capacity by this method is 1,444 kw.

In all of the above figures it has been assumed that the supply voltage remains constant, which as a rule it does not. If the variation is large, it should be considered when the calculations are made.

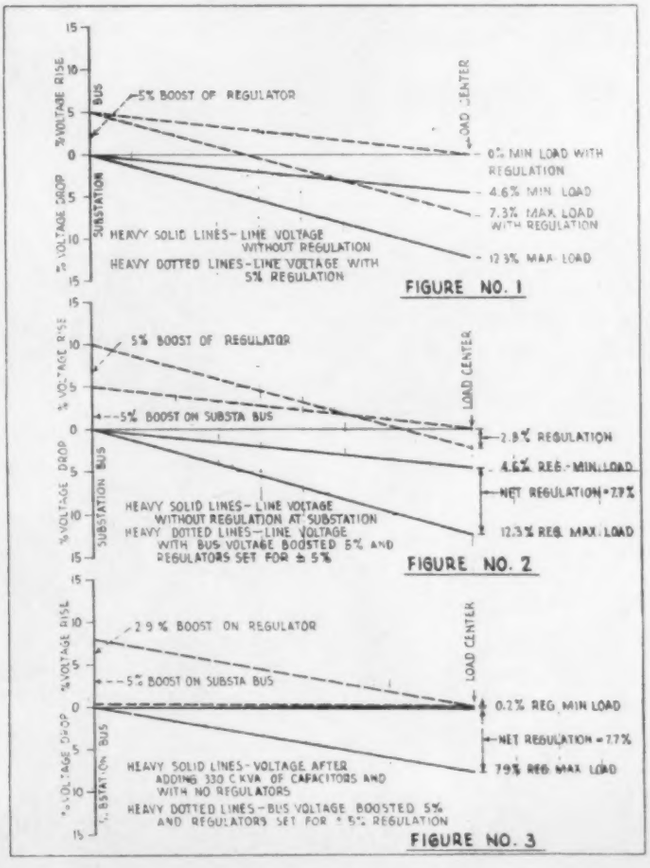
The above figures show that each of three methods of increasing capacity is feasible. The cost of each method will now be considered.

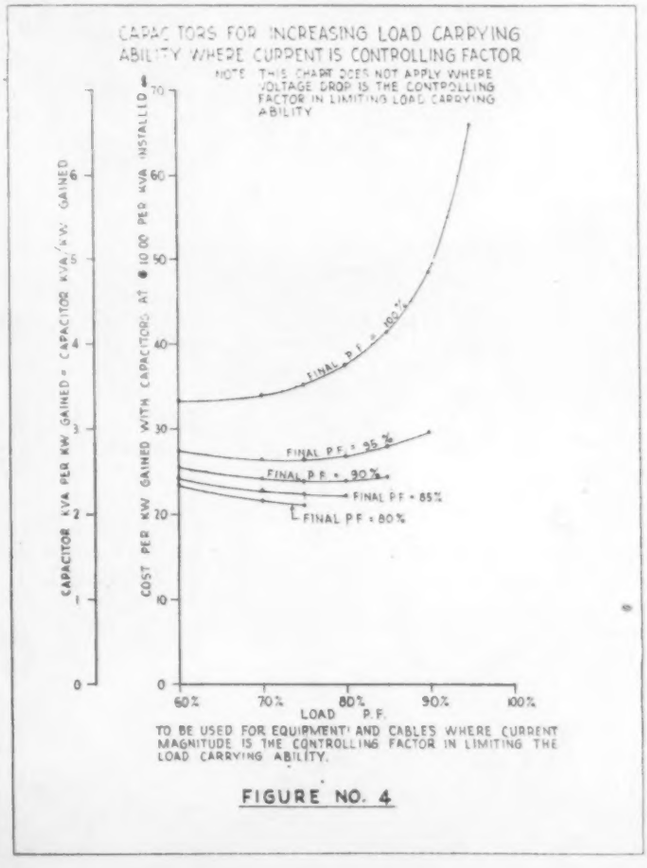
Cost of Shunt Capacitors

The average cost of capacitors, installed, is approximately $10. This may vary with voltage and size units but is taken as an average. On this basis the cost of installing 330 kva. of capacitors on the line would be $3,300. This gives an increase in line capacity of 242 kw. at an average cost of $13.63 for each kw. gained.

Cost of Adding Regulators

The estimated cost of adding two 300-amp., plus or minus 10 per cent regulation, induction-type regulators is $5,220. With a gain of 283 kw., this gives an average cost per kw. gained of $18.45. No salvage value has been allowed for the old regulator in this figure. This value would depend largely upon the possibility of using the regu-


% VOLTAGE RISE
% VOLTAGE DROP
BUS
SUBSTATION
LOAD CENTER
5% BOOST OF REGULATOR
0% MIN LOAD WITH REGULATION
4.6% MIN LOAD
7.3% MAX LOAD WITH REGULATION
12.3% MAX LOAD
HEAVY SOLID LINES - LINE VOLTAGE WITHOUT REGULATION
HEAVY DOTTED LINES - LINE VOLTAGE WITH 5% REGULATION
FIGURE NO. 1
5% BOOST OF REGULATOR
5% BOOST ON SUBSTA BUS
2.8% REGULATION
4.6% REG. - MIN. LOAD
NET REGULATION = 7.7%
12.3% REG. MAX. LOAD
HEAVY SOLID LINES - LINE VOLTAGE WITHOUT REGULATION AT SUBSTATION
HEAVY DOTTED LINES - LINE VOLTAGE WITH BUS VOLTAGE BOOSTED 5% AND REGULATORS SET FOR ± 5%
FIGURE NO. 2
2.9% BOOST ON REGULATOR
5% BOOST ON SUBSTA BUS
0.2% REG. MIN LOAD
NET REGULATION = 7.7%
7.9% REG. MAX LOAD
HEAVY SOLID LINES - VOLTAGE AFTER ADDING 330 C KVA OF CAPACITORS AND WITH NO REGULATORS
HEAVY DOTTED LINES - BUS VOLTAGE BOOSTED 5% AND REGULATORS SET FOR ± 5% REGULATION
FIGURE NO. 3


CAPACITORS FOR INCREASING LOAD CARRYING ABILITY WHERE CURRENT IS CONTROLLING FACTOR
NOTE: THIS CHART DOES NOT APPLY WHERE VOLTAGE DROP IS THE CONTROLLING FACTOR IN LIMITING LOAD CARRYING ABILITY
CAPACITOR KVA PER KW GAINED = CAPACITOR KVA/KW GAINED
COST PER KW GAINED WITH CAPACITORS AT $10.00 PER KVA INSTALLED
FINAL P.F. = 100%
FINAL P.F. = 95%
FINAL P.F. = 90%
FINAL P.F. = 85%
FINAL P.F. = 80%
LOAD P.F.
TO BE USED FOR EQUIPMENT AND CABLES WHERE CURRENT MAGNITUDE IS THE CONTROLLING FACTOR IN LIMITING THE LOAD CARRYING ABILITY.
FIGURE NO. 4

lators, and an appropriate amount should be subtracted from the cost of installing new regulators as given above. This would make the cost per kw. gained less.

Cost of Changing Voltage

The estimated cost of changing the voltage of the feeder from 2,300 volts to 4,150 volts Y is $8,000, taken from average costs of changing other similar feeders. With a gain of 1,444 kw. in line capacity, the average cost per kw. gained would be $5.54.

The addition of shunt capacitors or the changing of the line voltage to 4,150 volts would reduce the losses in the circuit, whereas, changing the regulators would have no effect on losses. In order to get the above results on a comparable basis the losses should be compared.

The savings in loss as calculated for the capacitors at 5 mills per kw.-hr. are approximately $240 per year on the present load. The savings in loss gained by using 4,150 volts instead of 2,300 on the same basis would be $280 per year.

Attention should be called to the fact that in these calculations, only savings in losses in the feeder itself have been considered. For the method of going to 4,150 volts, this is correct. However, in the case of the shunt capacitor, this reduction of loss is reflected from the capacitors back through the entire system to the generator. While these savings are real and appreciable, they have not been evaluated, due to the difficulty of doing this accurately.

The interest charges per year on the investment on a 12.5 per cent basis would be $412.50 for the capacitors, $652 for the regulators and $1,000 for changing the voltage from 2,300 to 4,150 volts.

The foregoing results appear in Table 1.

It will be noted that no account has been taken of transformer capacity. The addition of shunt capacitors is the only one of the three methods which will benefit transformer capacity — to the extent of 70 kw.

From the figures it is felt that increasing the regulator size would be the least economical of the three.

The choice of the other methods would depend upon the rate of load growth, and the situation in regard to transformer capacity at the substation. If the addition of capacitors would care for the load growth on the line without having to replace the substation transformers for several years, it is felt that that would be the most economical method. The capacitor installation has the lowest first cost, the lowest annual cost and the advantage that if at any time the load increase is enough to warrant changing the circuit to 4,150 volts, it has nearly 100 per cent salvage value.

Table I—Comparison of Costs for Increasing Line Capacity Only

	By Adding Shunt Capacitors	By Changing Size of Regulator from 200 to 300 Amp.	By Changing from 2,400 to 4,150 Volts
Circuit Capacity	951 kw.	992 kw.	2150 kw.
Capacity Gained	242 kw.	283 kw.	1444 kw.
Total Cost of Change	$3300	$5220	$8000
Cost per kw. gained	$ 13.63	$ 18.45	$ 5.54
Annual Saving in Losses	$ 240	None	$ 280
Annual Interest Charge	$ 412	$ 652	$1000
Interest Charge—Saving in Losses	$ 172	$ 652	$ 720

Capacitors for Increasing Load Carrying Ability Where Current Is Controlling Factor

In the study of the 2,300-volt overhead distribution feeder, it was found that voltage regulation to the load center was the limiting factor in determining the maximum load carrying ability of the line. In general, it is safe to say that permissible voltage regulation is the load limiting factor for most open wire circuits insofar as the line itself is concerned. On the other hand, the station equipment, such as regulators and transformers, have a current (or kva.) rating which limits load carrying ability. Likewise underground cables and other closely grouped conductor circuits have definite temperature limits, which means their load carrying ability would be limited by current (or kva.) in many cases rather than by voltage regulation. Where current is the load limiting factor of the circuit or equipment, or both, then the load carrying ability and the cost of capacitors per kw. gain is on an entirely different basis than that encountered in the problem of the open wire primary feeder.

Where current is the load limiting factor, then voltage regulation and circuit constants are out of the picture and the basis for all calculations is the well-known relation that kw. = kva. × p.f. This is the basis for Fig. 4, which was developed to show the cost of capacitors per kw. gained when going from a lower to a higher p.f. For the purpose of this chart the cost of capacitors installed was taken at $10 per kva.

Referring to Fig. 4, the use of the curves will be illustrated with a simple problem which is not for the purpose of justifying or discrediting the use of capacitors in obtaining additional kw. capacity where current is the controlling factor in limiting the load carrying capacity.

For simplicity, assume a 1,000-kva. transformer loaded to capacity at peak hours with a load p.f. of 75%. Assume that capacitors are to be installed to bring this load p.f. up to 95%. By use of Fig. 4, the cost of capacitors per kw. gained may be obtained by projecting upward from 75% on the load p.f. scale to the curve marked "Final p.f. = 95%." Then read the cost of capacitors per kw. gained on the vertical scale. In this case, the cost is about $26 per kw. gained. The capacity of the 1,000-kva. transformer at 75% p.f. is 750 kw. and at 95% p.f. is 950 kw., so a net gain of 200 kw. is obtained. On the vertical scale marked "Capacitor kva. per kw. gained" the reading is 2.6, which means 2.6 C. kva. is required for each kw. gain. The total C. kva. required would be 200 (kw. gained) × 2.6 = 520 C. kva. and the total investment would be about $5,200. For comparison, assume the original load p.f. was 95% at peak load and the desired final p.f. was to be 100%; then the cost per kw. gain would be about $66, the net kw. gain would be only 50 kw. and 330 C. kva. would be required at a total cost of about $3,300.

The illustration given merely indicates the nature of the problem when current is the load limiting factor. No one would consider installing capacitors at $66 per kw. gained to obtain an increase of 50 kw. in transformer capacity and even $26 per kw. gained for a 200-kw. gain in capacity would not be attractive if only consideration was the gain in the transformer alone.

Actually, the installation of capacitors out on a feeder yields a gain in load carrying ability in the feeder, in the regulators and transformers, in the sub-transmission and on back all the way to the generators. The value of this accumulated gain, in any specific problem, determines whether capacitors are the most economical method of increasing load carrying ability .

The value of a kw. gain in a power system may vary over a considerable range and a detailed study would be required to determine it for any specific problem. The points where capacitors might be expected to apply most readily be where peak load power factors are relatively low, where circuits and station equipment along the path of power flow from generators to load are loaded to capacity and where the cost per kva. of increasing that capacity is relatively high or requires a heavy capital investment which might be deferred for several years by installing capacitors. Furthermore, when the load growth of the system made it necessary to install more system capacity in equipment lines, the capacitors would still be beneficial to the extent that they reduce the I^2R losses and voltage drop all the way from the generator to the load.

Discussion

Corbett McLean—We have used capacitors in outlying substations in urban districts but not on rural lines. In one case we had a peak of 240 to 255 amps. on a 200-amp. regulator. The power factor was 79 per cent. A 1,500-kva. capacitor would have been required to bring up the power factor. We found that we could install a new feeder and save $4,000 as against the cost of the capacitor.

L. R. Gamble—We have not found a condition to require the use of capacitors, although we may in the future.

A. B. Campbell—Capacitors have had an application in coordination work between rural power lines and telephone lines. The question is whether to add capacitors or to put a metallic ground on the telephone system. In some cases capacitors have been used and found satisfactory.

W. S. Hill—In recent years we have used 1,800 kva. of capacitors in 300-kva. units, and saved 500,000 kw.-hr. of line loss, reclaiming 1600 kw. of station capacity by raising the station power factor from below 60 to above 80. In one small town we put a 15-kva. capacitor on the line to secure economy in the operation of a small diesel generator.

A. Vilstrup—We have also used capacitors to improve the system power factor, though in some cases we improved voltage regulation in industrial plants by getting the customer to use synchronous motors. The application of both these corrective measures improved the system power factor materially.

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Radio Interference, Hum Modulation

By O. W. HURD and A. O. MANGOLD
Northwestern Electric Co.

RADIO interference has been the concern of electric utilities since the beginning of broadcasting. When compared with the conditions that existed when radio receivers were first introduced into the home, power company equipment is today practically free from radio interference. Most of the interference now experienced is from sources beyond the control of power companies. This paper, presented also before the Portland Section and Corvallis Student Branch, A.I.E.E., March 29, 1938, describes a new type of interference which, although usually caused by conditions existing in customer-owned equipment or wiring, is usually referred to the power company for solution.

It has been the writers' experience that in every case where this new type of interference was investigated the customer had first called in a radio service man who invariably would attempt to remedy the trouble by making some repair to the radio receiver. Failing in this, he would advise the customer to call the power company. Due to the lack of knowledge of the causes of external hum modulation, most service men are unable to analyze this trouble and effect a remedy. Many radio complaints now being received by power companies would be avoided by a more general understanding of this problem by radio technicians. It is suggested that if power company engineers would familiarize the fraternity of radio technicians in their respective operating territories with the contents of this paper that practically all cases of hum modulation could be eliminated directly by service men, thereby increasing the latter's revenue and reducing the number of service calls made by power company engineers.

Although the conditions necessary to create this type of interference may exist in a suitable circuit, actual interference does not occur unless the signal strength of the broadcasting station is comparatively high, usually greater than 10 millivolts per meter. Since the trend in modern broadcasting stations is to increase field intensity within their primary areas, and thereby minimize the effects of the more common causes of interference, it may be expected that 60-cycle hum modulation, due to accidental rectification, is a problem which will demand more attention in the future.

Until recently intereference has been more or less confined to those causes which produced a direct radiation with a signal strength or noise level above that of the signal received from the radio station transmitter. With the advent of greater power and more efficient radiators today's broadcasting station has a signal intensity within its primary area that quite effectively minimizes many of the common causes of radio interference found troublesome a few years ago.

This increase in power and efficiency, however, has not been the expected "cure-all" for interference troubles as, it has been discovered in recent months that the greater signal strength can produce a very disturbing type of noise or hum caused by 60-cycle modulation of the carrier frequency when certain conditions obtain. While this type of interference probably occurs less frequently than others, it usually persists until something is done to correct it, and its effect is greatest on the strongest broadcasting stations.

Conditions For Occurrence

In order that this phenomenon occur the following two conditions must exist:

(1) There must be a non-linear impedance or rectifier in a circuit acting as an antenna. This may be the antenna to which a receiver is connected or in the circuit connecting the receiver to ground. The latter has been found to more frequently contain the non-linear impedance or rectifying element. It may also be in any electric circuit acting as an antenna and capable of re-radiating energy to nearby radio receivers. Some examples known to contain rectifying elements and cause interference are: open house wiring, poorly grounded or ungrounded conduit systems, hot water piping, sanitary plumbing, etc. Transformerless radio receivers and intercommunication systems possess the necessary element to produce this type of interference.

(2) In any of these circuits there must, in addition to the radio frequency currents, be some 60-cycle current. Since the necessary amount of 60-cycle current is only a few microamperes, its presence might be accounted for by a small capacity charging current or a leakage through a high resistance path. Another possibility is that of 60-cycle earth currents when the rectifying element occurs at the point of contact between a driven or buried ground and earth. In one instance, where rectification was occurring at some point in the buried portion of the grounding rod and causing 60-cycle modulation of the carrier wave of all local stations, an a.c. voltage existed between this ground and the water system. It was determined by means of an oscilloscope that this potential was due to earth currents of both local power systems.

Other Causes and Effects

Conditions within a radio receiver may cause this type of interference. These are understood by service men and can be corrected by them. However, only those external to the receiver will be considered. It is further recognized that the conditions causing 60 cycle modulation may also result in external cross modulation of two or more strong broadcasting stations.

Types of Non-Linear Impedance or Rectifiers

The type of non-linear impedance in the above mentioned circuits, is of an accidental nature and therefore does not lend itself readily to examination. It is hoped that in the future sufficient field data will be obtained to permit a more complete analysis. However, there are many types of rectifiers that can exist by accident.

Oxide Rectifiers

Probably the rectifier that would occur most frequently by accident is the oxide type. It has been found that many metals and their oxides may, under favorable conditions, act as rectifiers. The most common of these is cuprous oxide. Grondahl and Place[1] found in experiments that copper oxide rectifiers for radio frequency currents

are highly efficient under certain conditions. They found that the efficiency at radio frequencies is increased by a reduction in area of the rectifier. This reduces its capacitance. Also, if a radio frequency reactor were placed in a circuit with the rectifier it would further decrease the effect of the capacitance of the unit. They further determined the forward resistance of the rectifier is greatly decreased by an increase in the current density. These facts help to explain why the type of rectifier that might occur accidentally acts so efficiently inasmuch as the reactance of the antenna coil of the receiver might decrease the effect of the capacitance of the rectifier and the 60-cycle current would incrase the current density to a point of greater rectification. Figure 1 is a volt-ampere characteristic curve of an instrument type of commercial copper oxide rectifier.

It is not necessary for the rectifier to have such pronounced characteristics as shown in Fig. 1, as a very slight amount of non-linearity will produce 60-cycle modulation. The depth of modulation increases as the characteristic curve approaches that of the ideal rectifier.

An instance where a copper oxide type of rectifier occurring accidentally in a buried ground produced severe 60-cycle modulation recently came to the writers' attention. A copper coil, originally used in a gas water heater, was buried in wet earth for a radio ground. When the radio ground connection was transferred to either a driven ground or the water system the 60-cycle modulation ceased. The heat treatment which the copper coil received when used as a water heater, had evidently produced a copper oxide rectifier. Attempts to obtain data for plotting the volt ampere characteristic curve failed because of galvanic voltages and earth current from d.c. street railway lines and a.c. power systems. An attempt to reproduce the effect by heating a copper rod in a gas flame and then allowing it to cool slowly, produced an element having definite rectifier action.

Although much attention has been given copper oxide rectifiers because of their efficiency and stability, there are other metals and oxides, when arranged in an electrical circuit, that possess non-linear volt-ampere characteristics.[2] A copper wire wrapped around an iron pipe with a film of rust or iron oxide between the wire and pipe has been known to cause interference.

Contact Rectifiers

Frenkel[3] found that clean metals in contact had non-linear chraacteristics when voltages in the order of 0.1 to 4 volts are applied.

Another type of rectifier is that formed by unlike metals in point contact. Chakravarti and Kantebet[4] conducted experiments with six different metals in five combinations: copper-iron, copper-tin, tin-zinc, zinc-iron, and lead-tin in point contact, determining their volt ampere characteristics under varying temperatures and pressures, and reached the following conclusions:

(1) A contact between points gave better rectifying characteristics than a contact between point and plane. (2) Heating destroys the rectifying properties of the contact. (3) The farther apart in the thermo-electric series the two metals are, the better the rectifier. (4) Metal contact rectifiers are best on a.c. voltages in the order of a few millivolts. (5) Metal contact-rectification is explained on the assumption that after application of the EMF a thermo-E.M.F. is generated and the contact resistance varies.

The interference resulting from a point contact of two metals, such as a conduit and water pipe, is thought to be caused by a rectifier of this type. An instance occurred locally where this condition resulted in hum modulation on two local station on all receivers for a distance of five blocks along one street. Fig. 2 is a characteristic volt-ampere curve.*

Formation of Rectifiers By Chemical Action

A. G. Bulen[5] in *Electrical Review* has advanced the theory that chemical action may be responsible for the formation of a chemical coating over parts or all of the grounding electrode, converting its contact surface into a half-wave rectifier. Instances of interference caused by rectification at the grounding electrode can best be explained by this theory.

Nature of Rectifiers

Since it has not been possible to obtain sufficient data on the type of rectifier that actually gives rise to this type of interference, the exact nature of these non-linear impedances is yet to be determined. To the writers' knowledge no qualitative data have been obtained to substantiate the various theories.

Modulation By Means of a Rectifier

The explanation of modulation by means of a non-linear device can best be understood by consideration of its current output.[6] [7] Again referring to Figure 1, which shows a typical volt ampere curve of a rectifier of the type under consideration it is seen that, due to its non-linear properties, the resistance to current flow is less for positive values of voltage than for negative values.

Since the radio receiver is tuned to the carrier frequency the only frequencies which will be amplified and detected are the sum and difference of the 60 cycle voltage and carrier frequency. The detector of the receiver will reject the carrier frequency and the only one appearing at the output of the receiver will be the 60 cycle frequency. When modulation is present on the carrier frequency then the resulting wave form becomes more complex with the modulation frequency of the carrier being modulated with 60 cycles.

External Cross Modulation

The modulation of one station may appear on the carrier of another due to causes external to both receiver and broadcasting stations. When only one strong carrier is present and the 60-cycle voltage is absent then the only new frequency generated will be multiples of the fundamental, principally the second harmonic. When two or

* From the Institute of Radio Engineers Proceedings for September, 1932: "Current Rectification of Metal Contacts," by S. P. Chakravarti and S. R. Kantebet.

Fig. 1—Current-voltage characteristic of copper-oxide element

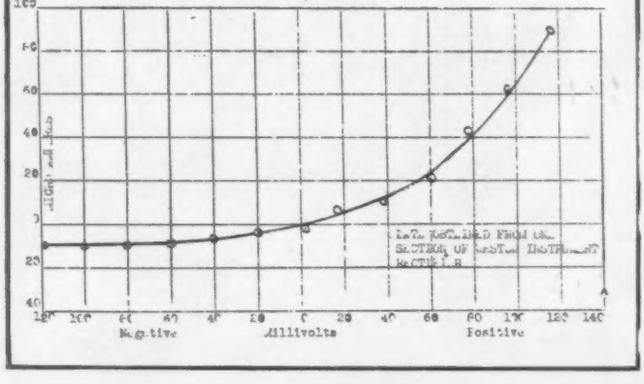
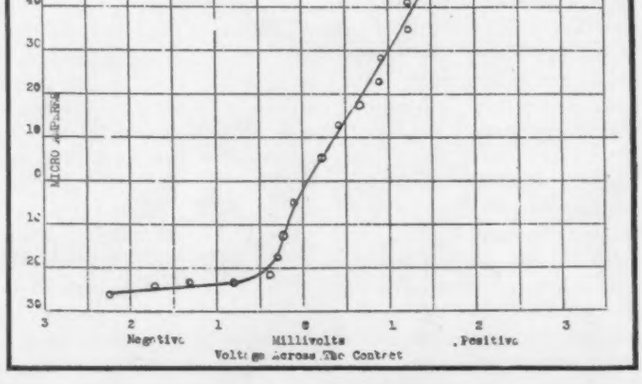
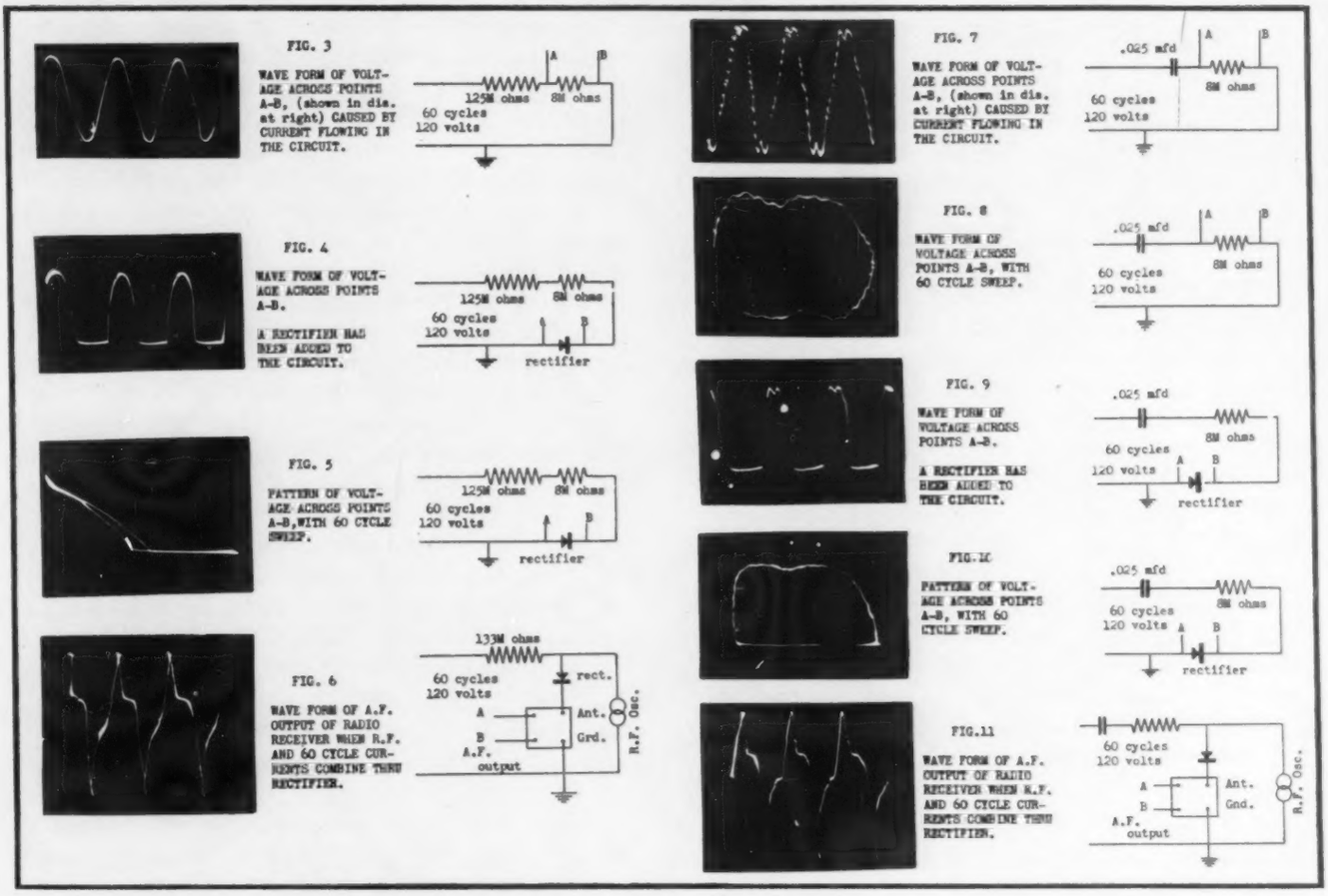


Fig. 2—Current-voltage characteristics of rectification by copper-iron contact





more strong carrier frequencies are present then many new frequencies may be generated and the modulation of one will be heard on the other. Although instances of external cross modulation have rarely been experienced locally, in the vicinity of powerful eastern broadcasting stations this phenomenon more frequently occurs. Engineers of Station WLW, Cincinnati, Ohio, made a report to the Federal Communications Commissions on external cross modulation based on an investigation of more than one thousand cases[9].

Study of Modulation With an Oscilloscope

Oscilograms in Figs. 3 to 11 were obtained by use of the instrument rectifier whose volt-ampere curve is shown in Fig. 1. The 60-cycle current was obtained from a 125-volt source in the manner shown by the wiring diagrams, and the radio frequency current was produced by an unmodulated oscillator. Figs. 3 to 6 inclusive, show the resulting wave form when a 60-cycle current was passed through a high resistance. Figs. 7 to 11 inclusive, show wave forms resulting when the 60-cycle current was from the charging current of a small capacitator. Since the 60 cycle current causing hum modulation is that which ordinarily passes through a capacitor, the capacitance of an electric circuit, or transformer winding of a radio receiver, the latter group of diagrams simulates the condition most frequently encountered.

Relation of Field Strength

By examining Fig. 1, it is seen that the curve is rectilinear for extremely small voltages. This explains why this type of interference frequently occurs only when the signal voltages are high. Several instances of this type of interference disappeared when the power of the local broadcasting stations was decreased at sundown. This is further verified by the fact that when 60-cycle modulation occurred on some stations it was not present on weaker stations.

Methods of Elimination

Although the most desirable method of eliminating this interference would be to find a defective connection or imperfect contact causing the rectification and eliminate it, this is not always possible. If it occurs in the antenna or ground wire of the receiver affected by the interference, it is usually possible to locate and correct the trouble. But if it occurs elsewhere the usual means of locating the interference source are of no assistance. If the source of the trouble is in the house wiring or conduit system then these systems can be caused to act less efficiently as an antenna by by-passing the radio frequency currents to ground through suitable condensers. The proper location of these condensers is not necessarily at the outlet to which the receiver is connected but at any point or points that will most effectively cause the wiring to act less efficiently as an antenna.

Conclusion

Since the rectifier is most frequently found at poor ground connections, or driven grounds, it would suggest that the ground connection be made to the water pipe at a point where it enters the building, with an approved clamp. If the trouble is not eliminated by checking all ground connections on receivers in the area affected, conduit and armoured cable used in house wiring should be checked to see that they are properly grounded. As a last resort, condensers should be used to reduce the interference.

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EDITORIAL

Bonneville's Kilowatt-Years

WITH a great "Hip! Hip! Hooray!" the kilowatt-year rates for Bonneville power have been announced to the public. Now that the proposed schedules are revealed, it is time for the industry to do a little judicious analyzing so as to tell the public quite frankly just what the rates will mean. In many respects Mr. Ross has performed a service for the industry. He has opened the way for a better public understanding of electric rates in general. For year the utilities have struggled to impress upon the public that electrical energy cannot be delivered in little packages when and as required, but that the time it was required and the amount required (kw. demand) were important in determining the cost of the kilowatt-hours. Because of his position of authority and the present attitude of the public, Mr. Ross may succeed where the utilities have failed.

Mr. Ross says that the price per kilowatt-year is a "wholesale" price and that the public will buy at retail in the familiar kilowatt-hours. Without explaining why, he leaves the way open for explanation. He urges that schedules be such as will encourage 24-hour use. He does not explain how this may be done nor does he give credit to the existing utilities for what they have already done in developing such rates. The industry has long recognized the difficulty of educating the public on the subject of greater use. Schedules have been so framed that additional use is encouraged by low follow-on rates, both on a monthly block basis and on a peak demand basis. However, few if any customers can state just how low the rate per kw.-hr. really is for additional use on present schedules. They think of rates in terms of the top block only. Mr. Ross' propaganda should enable the utilities to point out how greater use means reduced energy costs.

Mr. Ross does utility management an injustice when he declares that the kilowatt-year rate is new. The industry has used it for years. It is nothing but the familiar demand charge of existing two-part rates, except that Mr. Ross makes his charge high enough to cover the entire cost. This is an appropriate schedule for Bonneville or any other stream flow hydroelectric project. It is not appropriate for steam plants or hydro systems which depend upon storage.

Mr. Ross does not make clear that a flat kilowatt-year charge to general customers would be uneconomical and wasteful, since it ignores the fact that often one customer has need for energy at a time when another customer does not. To induce the latter customer to use energy (or pay for it anyway) when he has little or no need for it, is both impractical and wasteful.

Mr. Ross says in one of his public statements that rural electrification associations "buy their current wholesale and usually pay more than 1c per kw.-hr. That is equal to at least $87.60 a kilowatt-year. At so high a wholesale rate electricity cannot be delivered at a cost which will encourage farmers to use much more than a few lights and appliances." Of course Mr. Ross does not mean to say that by paying 1c per kw.-hr., these associations actually pay $87.60 per kw. of maximum demand. Really such customers will use a kilowatt of demand on the average about 3,000 hours per year and thus pay $30.00. In announcing his $17.50 per kilowatt-year rate on the transmission system, Mr. Ross fails to point out that the cost of step-down and sub-transmission to the point of use must be added. These additions on the average should increase the cost to a figure close to $30 per kilowatt-year or about 1c per kw.-hr.

Mr. Ross has referred to the high average use of electrical energy on California farms. Anyone familiar with the facts knows that this is primarily due to the irrigation requirements of California agriculture. In that state power for irrigation is sold on a two-part rate schedule consisting of a fixed charge per horsepower per year plus a charge for the kilowatt-hours used, made up of several blocks of which the terminal or follow-on block rate is considerably less than 1c per kw.-hr. Last year with such rates, Pacific Gas and Electric Co. served some 584,000 hp. of irrigation motors from which the total revenue was $8,915,000, an average of $15.25 per hp. per year. As one horsepower of motor load will require about one kilowatt of transmitted power on the main transmission system, it would appear that California farmers are purchasing agricultural power at considerably less than Mr. Ross' proposed rates. That power can be sold for such a low rate as $15.25 per hp. per year is due to the high diversity of use. These farmers used an average of only 912 kw.-hr. per hp. per year. Their motors were in use only 12 per cent of the time, but power did not go to waste when their motors were idle. On the average the total peak demand on the P.G.&E. system was used more than 60 per cent of the total time for the year. This is but one example of the thing Mr. Ross urges, namely, diversity of use and consequently low cost for each individual use.

Mr. Ross has stated that his kilowatt-year rates are new to American practice but that they have

ELECTRICAL WEST

DEVOTED TO THE ECONOMIC PRODUCTION, TRANSMISSION AND DISTRIBUTION OF ELECTRIC POWER AND ITS APPLICATION TO INDUSTRY, COMMERCE, AGRICULTURE AND HOME IN THE PACIFIC EMPIRE, AND TO THE MARKETING OF EQUIPMENT AND APPLIANCES AND OTHER UTILIZATION DEVICES IN THAT AREA

been used by the Ontario Hydro Commission as a basis for wholesaling power to Canadian municipalities for years. As a matter of fact the flat annual charge per kilowatt, per horsepower or per lamp was the first method of rate making used by the industry because at the inception of central station power service there were no electric meters. It was the method used in California mining regions before electric power transmission over long distances was invented.

Mr. Ross should not let the public be confused by believing that his kilowatt-year rates will mean universally cheap power at the customer's meter. He himself has said that generation is but a fraction of the cost of electric power delivered; that distribution is eight or ten times more costly.

Such considerations as these do not detract from the fact that Bonneville power can be a great boon to the Northwest. However, the public should know all the facts about it.

He took the words—

ALMOST any speech that W. C. Mullendore delivers contains an editorial. Particularly apropos was the talk he delivered at the Industry Conference, at Hollywood, May 19, called by the Electrical Development League to launch the adequate wiring program. Excerpts from his text will write a truly all-industry editorial for us:

"First let us agree that we have no cause for apology when we recommend the use of any established device to our customers . . Second, let those of us who are not directly related to the sale of apparatus learn as much about them as we can so that we may speak with some semblance of authority . . My third recommendation is that we recognize that each branch has a legitimate part to play in the advancement of our common cause. Each is the result of natural evolution and though we may feel at times that one or the other of them is a handicap to our personal progress, a little intelligent analysis will reveal that we are all interrelated and that each of us is to some degree affected if one of the branches is not allowed to function in its natural way.

"In the fourth place, let me remind you that, in this selfish world, no outsider is going out of the way to help us—any progress that is made will be by our own efforts. You may wonder why I introduce this thought; there are numerous influences at work in the world which tend to break down individual initiative and responsibility . . throughout our social structure there are voices that whisper, 'don't worry; Uncle will take care of you.'

"This is a far cry from pioneer days, when every man slept with his boots alongside the bed and a six-shooter under his pillow. Somewhere between these two extremes is a middle ground where private initiative flourishes and the individual prospers. I have said that no outsider is going to help us. All social planning is aimed at those who fail: it is our ambition to succeed, and any success attained will be through our own efforts alone.

"Hence we have conferences, such as this, where the branches of our industry can get the feeling of unity, capable of surmounting obstacles too great or too hazardous for individual attack. To my mind there comes the picture of a group of Alpine climbers tied together with strong ropes. If one slips, the others save him from a dangerous fall. But remember, each climber must do his part, through his own personal effort, if the goal of the expedition is to be reached."

Convention Inspiration

SINCE devotion and cooperation, the two attributes which Dr. Paul Cadman emphasized as so vital to growth and progress, are dependent upon an emotional and inspirational source of replenishment, the Pacific Coast Electrical Association is wise in the division of its meetings into three types: divisional meetings to acquaint remote members with its program, conclaves through which to apply the democratic conference method to the solution of definite problems and the convention for inspiration and reassurance of the worthwhileness of effort and devotion to the job.

The convention in San Francisco fulfilled this third function admirably, even as the conclaves and district meetings served their own worthwhile purposes. Its program was such that no one who participated would leave the convention without a greater respect for his industry, a better appreciation of its widespread ramifications, the inspiration of the goals it has set for itself. Those who came, did so with the work of the year accomplished and an open mind ready to absorb as much from its sensibly short sessions as possible. There was a happy party and entertainment to top it all off and to serve as the medium by which a more friendly acquaintance—a closer personal tie between those engaged in different departments, divisions, regions, or branches of industry activity —could be murtured.

From the latter the groundwork for cooperation is derived. It shall be easier to proceed from that base of friendship. It will be natural to devote more to an industry so vital, so necessary and so varied as that revealed at the convention.

P.C.E.A. Plots Industry's Advance

INSPIRATIONAL, stimulating, bubbling with optimism for the future of all branches of the electrcial industry—this was the general impression carried home by the 600 delegates to the Pacific Coast Electrical Association's twenty-first anniversary convention at the Fairmont Hotel, San Francisco, May 26 and 27. From the opening gun fired by president R. M. Alvord till the last strains of "Home Sweet Home" reminded the delegates that the party was over, the convention exuded harmony and cooperation.

All branches of the industry—utility, manufacturer, wholesaler, dealer, contractor—were present in balanced proportion, and each contributed equally to the program. The individual problems of no one group dominated the discussions, but rather, the broad overall problem of the entire industry—how to bring about better conditions for all engaged in it—was emphasized or implied in every presentation. Nor was that other great factor in industry success—the public—overlooked. One session, Thursday night, was dedicated to the public, particularly those groups whose work or services touched the fringe of our own industry's activities, such as architects, building contractors and realtors. Here some of the less technical subjects of the general convention were dressed up in slightly different garb and presented to a crowd of 300 assembled under the auspices of the San Francisco Electrical Development League.

Replete with "big names," the program covered a wide range of subjects —from the realm of pure science, through the more prosaic business and commercial aspects, to the brilliant inspirational address of Dr. Paul F. Cadman that closed the last session—but underlying it all was the clear-cut theme that the industry could go forward toward prosperity for itself and an increasingly higher standard of living for the public, with all its elements performing their respective functions and participating equitably in the benefits. Action, dramatics and showmanship were brought into play, with demonstration equipment, lighting effects, slides, movies and other mechanics, to save words and to make the effects more vivid and lasting.

The old saw about what "makes Jack a dull boy" was not forgotten, and golf and sight seeing were lavishly provided, with special parties for the visiting ladies. In tune with the times, a brilliant night club party in the hotel, complete with cocktails and dancing, closed the convention. And so, home, with new vision, new inspiration and new will to carry out through a united front the high ideals charted in the convention hall.

Detailed accounts of the subjects and the manner of their presentation follow.

Modern Alchemy Yields New Medical Weapon

TACKLING physics' most baffling phenomena in a way that made them seem simple, Dr. John J. Livingood, of the University of California outlined what may develop into an entire new field of electrical usefulness. His subject, first on the program, was "Electrical Methods of Transmuting Matter."

CONGRATULATIONS
President R. M. Alvord and President-elect A. E. Hitchner exchange congratulations on a good job done and an election

STANLEY SCARFE
He may earn his money from G-E, but as general chairman he did the work in putting the convention over

"Alchemists of a century and more ago," he said, "failed because they lacked knowledge of the composition of matter. They strove to make gold from lead. Today we can make gold from platinum, but, economically, that hardly fulfills the alchemists' dream.

"But although today's transmutations may cost more than the metal they produce, they are yielding data on the structure of matter which cannot be valued, and are producing radio-active substances whose benefits in biology and medicine can scarcely be imagined."

Materials with which the modern alchemist can work, Dr. Livingood explained, are the 92 elements. And his work consists of rearranging the protons and neutrons which are their common atomic constituents. Efforts of chemical scientists to alter atomic construction failed because the atomic nucleus is so tightly bound as to be invulnerable to forces produced by temperature or pressure.

Alpha particles accelerated by the exploding atoms of unstable radium were the first successful instrument for rupturing the atom. Since then, scientists have endeavored to find means of accelerating particles to speeds exceeding 15,000 mi. per sec.

Using lantern slides, Dr. Livingood described the cyclatron, a device which produces accelerations equivalent to those which might be produced by 8 million volts. It evades the impractibility or impossibility of producing such a voltage by using 80 kv. for giving particles successive boosts in speed. Imagine a 3-ft. pie, cut in half, with the pieces pulled slightly apart, enclosed in an evacuated chamber and placed in a high magnetic field. Electrons, emitted from a hot wire at the center are subject to the high magnetic field and to the potenial of the pie-halves, which are electrodes. This causes the electrons to spiral out, the potential alternating as they cross over the diameter. The target of substance to be bombarded by these fast moving particles is across a tangent to the perimeter.

Radio-active substances may remain so for hours or days. Dr. Livingood demonstrated their detection by sensitive apparatus and told how they can be swallowed and their presence detected in various parts of the human body. Thus the time for phosphorus to enter bones, or the effect of iodine upon the thyroid can be studied by watching the progress of these "marked" atoms. It is this effect, plus the possibility of therapeutic uses, that makes electrical transmutation an invaluable tool to medicine.

Programs Pave Way for Great Wiring Sales

LIKENING Red Seal activities and the National Adequate Wiring program to Mike and Ike, and using two well disciplined young gentlemen of about 11 and 13 years of age to further this simile Frank J. Airey of F. J. Airey Co., Los Angeles, hit hard at the industry's indifference to poor wiring. He spoke at the first morning's meeting.

"I'm not going to tell you new things," he said, "but I caution you not to dismiss this as old stuff."

"As an example of what I mean by our shortcomings, here are dozens of pamphlets got out by banks. They are literature destined to inform home-builders—those about to seek a federal loan and build a house. Yet in not one of these booklets is there the least mention of wiring."

He gave but one reason for this outside absence of understanding. It was, he said, a reflection of the industry's own internal indifference.

SPEAKERS

Frank Airey told the adequate wiring story dramatically and convincingly while E. C. Frellson of G-E Supply pleaded the case for the dealers

"There are 30,000 persons dependent upon the electrical industry in California for their livelihood," Mr. Airey pointed out. "Think what might happen if each of them adopted the slogan: 'Know it. Tell it. Sell it.' "

The idea of appliances' selling wiring he likened to a case of tail wagging dog.

Evidence that something can be done to improve wiring, and of just what this means in terms of electrical use were contained in his summary of the study of 100 Red Seal homes, compared to 100 non Red Seal homes. In the first were found 90 vacuum cleaners; in those not wired to the standard 57. Fans totalled 54 against 3, floor lamps, 316 to 224, and the same sort of evidence extended to all appliances with a greater ratio for the heavier ones. Average investment in appliances was $232 higher per home in the Red Seal group.

Mike and Ike set the stage with an illuminated chart which showed the floor plan of a modern home and indicated the great number of appliances which need outlets. Mr. Airey recalled that demand of a typical new home has jumped from 10 to 30 kw. in the last ten years. The "Wire for Tomorrow" idea, he said, indicate a market potential which exceeds what is today regarded as a generously adequate wiring job.

The sixty thousand homes predicted to be built in California within a year can, he said, mean $28,000,000 to the electrical industry. But to realize this, and at once, the industry must do one thing: work.

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Modernized Institutions Prescribed for Industry

ELIMINATION of waste effort by abolishing organizations which serve only to consume time and effort and to enhance the interests of a special group at the expense of the industry at large was urged by Earl N. Peak, president of the National Contractors' Assn. His, the third subject on the program, concerned "Industry Progress from a National Standpoint."

Essentials of a national or local industry program are, he said, three: (1) industry understanding, (2) industry planning, and (3) industry action. Industry understanding he identified as the particular shortcoming. But the fact that only a few years ago it took six months' effort to get two industry groups together, whereas today such groups are much more ready to cooperate is an indication of progress.

Confidence of everyone in his own branch of the industry is today's crying need, he said. With such confidence, each branch naturally would, in dealing with the public, have a good word for the other branches. He emphasized that today's competition is not between the industry's branches but between the industry as a unit and such items as automobiles and cosmetics.

Fair trade laws, existing in 42 states, he characterized as opening the way for unprecedented industry planning. Furthermore, he said, N.E.C.A. plans to prosecute every violation of the Robinson-Patman act in which the industry was affected.

For every locality he prescribed one good electric league, representing everybody, and advised consolidation in such a league of the special interests which now make for duplication and lost motion.

"Competition is severe," he said, "and if we let down for one second, somebody else is going to step in and do our job for us. Let's cast aside the habit of tackling our tasks with an eye to who's going to wear the feather in his cap, and, instead, concentrate on results."

●

Electricity Makes for World Fair's Success

NEXT year's Golden Gate International Exposition was the subject of a program following the first day's luncheon, at which James B. Black, president of Pacific Gas & Electric Co., presided.

"More and more," said Leland W. Cutler, exposition president and principal speaker, "have expositions come to lean upon electricity. It has been the leading factor in every successful exposition of the last generation. Next year's international exposition, in San Francisco Bay, will be no exception."

W. P. Day, in charge of constructing Treasure Island, on which the exposition rests, and of building the palaces and facilities, said facilities for distributing 14,000 kw. to the exposition

CONTRACTORS

Earl Peak, President of N. E. C. A., and A. L. Stone, N. E. C. A. executive committeeman for this district, were among the many contractors present

site have been prescribed, and the only question is whether these will be enough. He estimated that consumption will be 4,000,000 kw.-hr. a month.

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Eye Tests Prove Value of Lighting

THAT teachers have been among the slowest to recognize the burden being placed upon human eyesight by inadequate lighting was the declaration of Dr. R. S. French, principal of the California School for the Blind and president of the Sight Conservation Council of Northern California, in introducing a vivid and convincing demonstration of modern school lighting technique. Dr. French was assisted by Dr. Leland Brown of Stanford Uni-

versity and Clark Baker, executive secretary of the Sight Conservation Council.

"There is no need for disagreement in evolving a program for preventing eye defects and saving vision," Dr. French stated. Cooperation between all interested parties in which there should be no quarrels between professional groups must be aimed at three different phases of the school lighting problem he said. These are first, increasing the knowledge of the abilities and limitations of the eyes so as to prevent defects; second, a correction of the environment for seeing with particular reference toward increasing and improving the lighting for visual tasks, and finally, care in the preparation of materials supplied to the eyes, especially school texts. The last recommendation applies particularly to type and paper used in school books.

Dr. Brown reported upon tests which have been made of the vision of thousands of individuals.

Recommended intensities of the Sight Conservation Council for various seeing tasks in the school he gave as follows: drafting and sewing, 30 to 50 ft.-candles; office and study, 25 ft.-candles; classrooms, 20 ft.-candles; laboratory, 15 ft.-candles; auditorium, 10 ft.-candles (20 if used as classroom), and corridors, 5 ft.-candles. These are minimum requirements, he pointed out, drawing attention to the 30 per cent "shaking down" which usually occurs after an installation has had a few months of service.

Mr. Baker presented a realistic demonstration of proper school room environment for adequate seeing. The demonstration setup was a section of classroom equipped with modern proper posture desks. Wall finishes were pale green toned to provide a minimum reflection factor of 35 per cent near the floor and 65 per cent at the ceiling. The ceiling was flat white. The lighting was controlled by a photocell. Lights were arranged in two rows on separate circuits so that the one nearest the inside wall of the room could be turned on to provide the necessary 20 ft.-candles on dark days.

Modern school lighting technique was demonstrated in this model room set up on the stage

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Lure of Profit Can Bring Dealers Into Fold

HOW to bring the appliance dealer into the industry councils was the theme of an address by E. M. Frellson, merchandise manager, General Electric Supply Corp., Los Angeles. This was one of the contributions of Chairman H. C. Rice's Business Development Section to the convention program.

Trends of appliance merchandising have resulted in the absorption of a large portion of this business by retail outlets having little or no connection with the industry, he declared. Because of the closeness of the dealer to the public and because he reflects public thinking, he represents a liability in the industry's public relations program unless he can be brought into the all-industry associations. As the appliance business has grown in volume and public acceptance has increased there has been a complete reversal from the days when the utilities sold 90 per cent of the total, to a point where today 60 per cent or more of the business is going through channels which were classed as non-electrical just a few years ago. Since many of these newer channels of trade operate on a basis of securing volume through price, Mr. Frellson stated that there have developed many merchandising practices which are detrimental.

Dealers, he said, have a new set of problems which require study by and help from the other branches of the industry. These include the ability to maintain a profitable volume, the inroads of consumer cooperatives on the business, the problem of trade-ins and the matter of securing capable, trained salesmen. Unless they receive cooperation from the balance of the industry, he stated that dealers would form associations of their own for the solution of these problems without giving any consideration to the relationship of other branches of the industry to them.

While the manufacturers and distributors can make some progress in helping the dealer to meet his problems, he declared that no permanent solution will be reached without the sincere assistance of the utilities.

●

Bank Credit Helps Move Electrical Goods

WHAT banks can do to assist in promoting merchandising was ably and clearly presented by E. A. Mattison, vice-president, Bank of America, in a paper entitled "Relationship of Banking to Merchandising." He traced the development of installment selling from its initial application to automobiles up to the present day when almost anything may be bought on credit.

Banks have provided the credit stream on which merchandising has reached its high state of success, he stated. Installment selling only grew as banks were able and willing to extend credit. This they did initially to large commercial financing organizations. Of late they have gone into the business themselves. The electrical industry has a real interest in this newest development because as high as 85 per cent of some appliances are sold on terms.

He outlined some of the new techniques which Western banks have developed for the extension of credit to their customers. They have not only made installment loans available direct to the public but are merchandising this service. Herein lies an opportunity for cooperation between banks and the electrical industry. In the promotion of wider use of some of its goods and services the industry will find a ready ally in the banks, he said. Adequate wiring offers one such opportunity where merchandising and credit can work together. Banking is ready to provide modernization loans. It also can direct some of its advertising resources at

"A GOOD TIME WAS HAD . . ."
"Kelly" Courtright was congratulating Bert Reynolds (left) on his fine job as program manager. H. L. Farrar, president of Coast Counties, pauses with M. H. Schnapp of General Electric (center). Vice-president and General Manager F. O. Dolson of Nev.-Cal. was telling P. G. & E.'s Vice-President J. P. Coghlan about his trip to Sweden (right)

this market. He closed with a plea for a closer understanding between the electrical industry and banking, since many of the problems of each are similar.

●

Movies Picture Fight Against Wind and Water

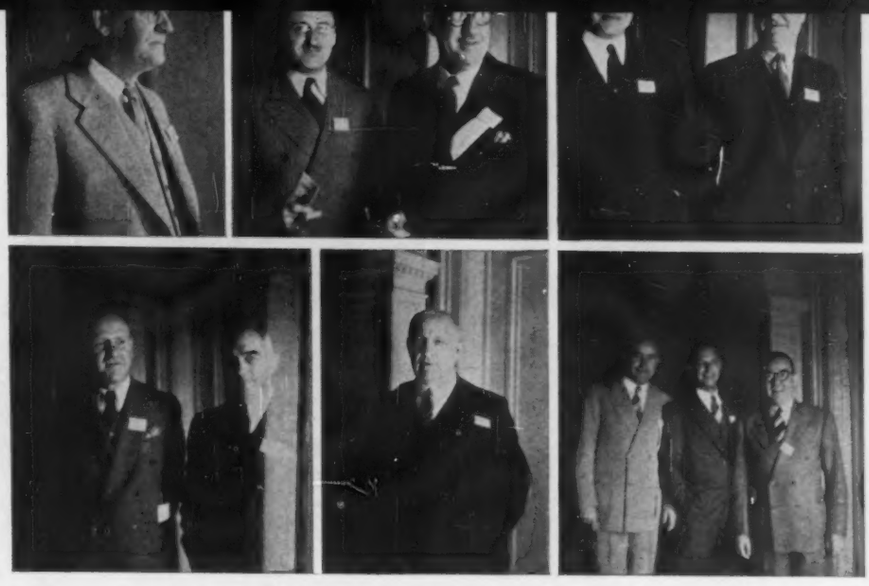
PAYING tribute to the men on the firing line for their devotion to duty, D. D. Smalley, general superintendent, San Joaquin Light & Power Corp., and chairman of the Operating Economics Section, gave a vivid description of "Service Despite Wind and Water" in which he reviewed last winter's storm damage to California utility systems and the steps necessary to maintain service. Lantern slides and two dramatic motion pictures graphically illustrated his word story.

Early in December utility systems were taxed to their utmost when 15 in. of rain fell in three days, causing unprecedented floods in the mountain areas where streams rose as high as 400 per cent over any previous flow of record. In this storm hydro plants bore the brunt of the damage with men marooned and plants submerged to their roofbeams. In one instance operators were taken from the roof of a plant on lines strung by a line crew.

Then on February 9 wind of hurricane proportions raked the San Joaquin and Sacramento valleys, coming in the wake of days of precipitation. Over 2,500 miles of transmission line and 6,000 miles of distribution line were put out of commission.

This was followed by a 30-in. rainfall in southern California between February 27 and March 3 with 14 in. of rain on March 2. Resulting floods washed out many transmission and distribution structures.

D. D. SMALLEY
San Joaquin's general superintendent, told what what storms do to utility systems and proved his statements with pictures



"IT WAS A GOOD CONVENTION . . ."
M. A. Pooler, vice-president and general manager of Tucson Gas, Electric Light & Power Co. (top left), came up from Arizona for the show. Next are P. G. & E.'s traveling sales counselors, F. U. Naylor and A. M. Frost. P. G. & E.'s president, and Jim Black, and San Joaquin Power's president, Emory Wishon (top right), are the electrical industry's contribution to the success of the Golden Gate International Exposition. E. J. Stahl, sales manager of San Joaquin Power, and Albert Cage, assistant general manager of Nevada California Electric (bottom left), had some agricultural power problems to discuss. Vice-president and General Manager P. M. Downing (golf prize winner) watched to see if the cameraman held the camera steady for a 1/10th-second exposure. H. H. Courtright, Valley Electric Supply president; D. D. Wheelock, Nev.-Cal., and E. P. Markee, G-E Lamp Division's Los Angeles manager (bottom right) laugh at one of Mox's funny stories

In maintaining service and repairing damage some 5,000 employees took part, drafted from every division of the utilities. Yet there was only one fatality —a power house operator lost his life when his station was washed completely away—and two serious accidents. In one of the latter a lineman was blown from a pole by the wind. A groundman saw him fall, caught him in his arms and received a severe gash the length of one arm from the lineman's climbers. The latter was uninjured.

One of the two motion pictures was a color reel showing Pacific Gas and Electric crews at work under trying conditions repairing storm damage. The second film was highly dramatic. It was taken by a power house operator at the Balch plant on the San Joaquin River. This stream, with a normal flood of 5,000 sec.-ft., carried 32,000 sec.-ft. at the height of the flood. The crew was ordered to abandon the plant. One operator who had his movie camera with him remained behind to take some pictures. He was finally marooned but he secured pictures of the full force of the flood flowing directly through the power house.

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League Sponsors Night Public Meeting

HOST to some 300 of the public, the San Francisco Electrical Development League sponsored an evening meeting, Thursday, in which four of the convention program features were repeated in slightly different form. Since the public group invited was a selected one consisting of architects, realtors and house builders, school officials and Parent-Teacher Assn. committees, the program was directed toward the interests which these people would have in electricity. Harry Carrol, president of the League, conducted the meeting and introduced each part of the program.

On the program were the adequate wiring story, dramatized in a different manner and presented from the consumer viewpoint; the school lighting presentation of the afternoon session, and the first presentation of the talk and demonstration on the use of electricity in modern medical practice by Dr. Garland. In addition to these the wind and storm damage, was shown.

Ray Taylor, commercial department representative for Southern California Edison Co., at Santa Ana, assisted by a personable young lady, presented the adequate wiring story.

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Electricity in Medicine Described by Doctor

"SCIENCE is a first rate piece of furniture for a man's upper chamber, if he has common sense on the ground floor," quoted Dr. L. H. Garland, visiting radiologist in charge of Stanford Service at San Francisco county hospital, in warning of quacks in medicine who may use electrical apparatus to dramatize their practice but who often do more harm than good. The quotation was from Oliver Wendell Holmes, and concluded a quiet, witty, and informative talk by this soft spoken and well informed doctor, both at the public meeting, Thursday evening, and at the Friday morning session. He was assisted by E. W. Philleo of G.E. X-ray

division, and a young man "patient" who demonstrated galvanic, radio therapy, diathermy, and fluoroscopic X-ray equipment during the course of the doctor's discourse. Slides, too, were used.

Dr. Garland showed first a diagram of the full known spectrum, and illustrated the various bands of wave energy which medical practice had found of value in the treatment of illness. Benjamin Franklin, he said, pioneered electricity in medicine, as he had pioneered in so many fields. Since his day each added bit of knowledge has been checked, accepted and used where indicated. How quickly medicine responded to the discovery of X-rays, Dr. Garland said, demonstrated that the medical profession would accept any new tool by which to diagnose or treat disease, once it is checked and proved efficacious.

In the field of light waves, infra-red, besides its use in heat application, is now used in photography of blood vessels. Ultra-violet light is used to bring the benefits of sunshine in dark climates. Dr. Garland jokingly referred to tan and the cult of sunbathing, giving little credit to the therapeutic value of tan. X-rays, though highly useful, Dr. Garland explained, do not provide real photographs and hence are easily subject to misinterpretation. He illustrated how easily wrong conclusions may be reached by inept healers whose knowledge of anatomy and the functions of the body are limited. It was then that he closed with his warning that the use by a healer of elaborate electrical equipment is no guarantee of his real worth, that the use of scientific tools really requires a knowledge of the human body too.

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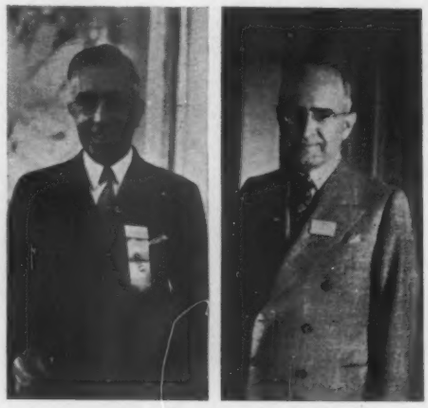
Research, Invention, Need Management, Says Cadman

PURE science and invention need the third element—management or promotion—to bring forth the benefits to the public of inherent values developed by science, and brought together into a useful article by invention. And all three—science, invention and management—can develop only through devotion, and cooperation. This was the essence of an inspirational talk which closed the convention, delivered by Dr. Paul F. Cadman, president of American Research Foundation of San Francisco, at the Friday morning session. With his knowledge of the industry, gained first by work as an electrician himself in early days and through contact and study since, Dr. Cadman drove his message home with illustrations taken from the industry itself.

Explaining that in modern "swing" musicians throw away all rules and do just as they please, he said that too much modern behavior and thinking is as unbridled. It ignores not only rules, but experience from the past. Taking Steinmetz as the prototype of pure science and research, Edison as that of invention, and Coffin or Westinghouse as those of management or promotion he illustrated the dependence of each on the other to bring about growth and development, to make jobs and opportunities. And the characteristic of greatest value to management is the knowledge of costs—how to control costs, how to disperse costs, how to direct effort to conserve costs. Only such management is able to "woo capital from the hands of the saver" in order to put it to use in production and distribution. And this wooing of capital to enterprise cannot be accomplished without the ability to give assurance of some degree of safety to the savings thus attracted. Men will not save and conserve unless they have some assurance that they can later enjoy the fruits of their struggles, their efforts, their denials and sacrifices. Even Soviet Russia has discovered that it cannot escape saving, to service and maintain equipment and to expand and develop it.

"SPEAKING OF COOPERATION . . ."

A. F. Morairty, vice-president, Central Arizona Power, and Earl Nilssen, Westinghouse advertising representative (left), had just heard the adequate wiring story. Vice-President Earl Fisher of P. G. & E. (center) was talking about his ranch. General Cable's Jim Crilly and Aluminum Co.'s Howard Flye (right) were not talking about the wire business



PLENTY OF SMILES

A. H. Nicoll of Graybar Electric was happy over the number of golfers signed up to play, while Edison's Vice-president and General Manager Fred Lewis smiles because he ran the PCEA last year

Another great truth ignored today, he said, was that there can be no wealth to distribute until it is first produced. When this electrical industry had begun to make its promotion of invention and science pay, he reminded his audience, it had turned back into science and invention endowments for their future continuance.

Without two prime qualities, also neglected today, he said, neither science nor invention nor production and distribution can continue—devotion, and cooperation. Science does not punch time clocks. There must be devotion that supercedes hours and wages. Without cooperation, without harmonious working together, there can be no production of wealth—no opportunity to save, to accumulate capital.

Dr. Cadman concluded by reminding the industry of the devotion of the past, of the fruits of its experiences during 60 years, of the benefits it had brought to human society and the humble pride it could take in the wealth, the comfort, the standard of American life that it had produced.

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Managing Director Tells of Year's Work Accomplishment

A SHORT business session followed Dr. Cadman's closing address, the purpose of which was to hear reports from the officers, elect new officers, and pass resolutions. President Alvord had already made his report at the opening session (printed in full on page 00). Minutes of the previous meeting were accepted and W. W. Glosser reported to the meeting for Treasurer N. R. Sutherland. L. M. Klauber read the resolutions committee report for A. E. Wishon. Dave Harris moved for a resolution honoring W. L. Frost, of Southern California Edison Co., who is retiring next month.

Victor W. Hartley, managing director, in his report, declared that the greater need for a well-knit industry in complete harmony, each company or branch establishing its plans and programs on

the basis of an understanding of their effect on the industry made great the opportunity of integration through the R.C.E.A. Membership, he reported, has increased to 99 class A, 2,773 class B, and 34 class C members, a gain of 177 for the year. He reviewed the conclaves held, also the work accomplished by the committees established to solve definite problems.

Reporting on the affiliated promotional agency, the Pacific Coast Electrical Bureau, he summarized its Red Seal wiring progress; announced 1,124 Red Seal homes certified during the past 12 months. Integration of the Red Seal plan with the National Adequate Wiring program should increase effectiveness, he predicted. Ordinance work has included a revision of the uniform wiring code for cities and counties; 60 cities and 4 counties have accepted it. Sales control ordinances have been given support where they are already in effect. An amendment to the penal code prohibiting defacing or alteration of manufacturers' trade marks, serial number or rating, has been made part of California law. Contact work with organizations in the building, inspection, contracting, and agricultural fields have also been part of this Bureau's activity, concluded Mr. Hartley.

The report of the nominating committee was read, and the recommended officers unanimously elected. The president elect, A. E. Hitchner, received his presidential button, conferred the past president's button on R. M. Alvord, and the convention officially closed.

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Hitchner Heads List Of New Officers

A. E. HITCHNER, Los Angeles district manager, Westinghouse Electric & Manufacturing Co., was elected president of the association for the year 1938-39, succeeding R. M. Alvord of the General Electric Co. From its membership the board of directors elected W. W. Glosser, Hubbard & Co., and C. E. Houston, Southern California Edison Co., as vice-presidents. N. R. Sutherland, P.G.&E., was re-elected treasurer.

Elected to the directorate for a two-year term were the following: H. H. Courtright, Valley Electric Supply Co.; P. M. Downing, Pacific Gas and Electric Co.; H. L. Farrar, Coast Counties Gas & Electric Co.; W. W. Glosser, Hubbard & Co.; H. L. Harper, Graybar Electric Co.; L. M. Klauber, San Diego Consolidated Gas & Electric Co; F. B. Lewis, Southern California Edison Co.; A. L. Stone, Stone Electric Co., and George C. Tenney, ELECTRICAL WEST.

Mr. Hitchner was born in Clayton, N. J., in 1882. He received his early education in West Jersey Academy and

A. E. HITCHNER
Westinghouse Los Angeles manager and newly elected PCEA president

was graduated from Rutgers College with the degree of B.S. in electrical engineering in 1904. During his college career he was a member of both the varsity football and baseball teams and captained both during his senior year. Following his graduation he was employed at the Baldwin Locomotive Works, Philadelphia, for two years and then spent two years in construction work for the Link Belt Co. Later he operated a mine in Florida.

He joined the Westinghouse organization in 1909 as a salesman in the anthracite mining district, later opening the company's Wilkesbarre office. In 1919 he was assigned to the East Pittsburgh staff as assistant to the manager of the industrial sales department. In 1926 he was appointed manager of the Los Angeles district office.

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Golfers Vie for Brace of Trophies

EIGHTY golfers pitted their skill against the hazards of the Lake Merced course in an endeavor to win one of the many trophies provided by J. E. Crilly and his golf committee. P. M. Downing, vice-president and general manager of the Pacific Gas and Electric Co., won the Addison B. Day trophy for utility men. Fred H. Cole, Bowie Switch Co., will have his name engraved on the Byllesby trophy and Frank Angle, San Francisco district manager, Allis-Chalmers Mfg. Co., won the Pelton cup. Incidentally he won acclaim for his hole-in-one, made on Merced's short seventeenth. Other winners were:

First flight: low gross, Rodger Mendes, Pacific Gas and Electric Co.; first low net, Fred H. Cole; second low net, E. B. Schoenberger, Pacific Gas and Electric Co.

Second flight: low gross, F. C. McLaughlin, Southern California Edison Co.; first low net, P. M. Downing; second low net, Frank Angle.

Blind Bogey: first draw, H. D. Hawks, Anaconda Wire & Cable Co.; second draw, Lee Lethine, Anaconda Wire & Cable Co.; third draw, George T. Bryant, Economy Fuse Co.; fourth draw, James Kastle, San Joaquin Light & Power Corp.; fifth draw, Charles Weiss, San Diego Consolidated Gas & Electric Co.; sixth draw, C. E. Young, Pacific Gas and Electric Co.

●

Banquet and Party End Convention in Gaiety

FOR a two day convention, so packed with event and program, the entertainment proved to be surprisingly ample for even the most sophisticated.

Rather than permit the old time custom of manufacturers' entertainment in rooms throughout the hotel, perhaps leaving some of the conventioneers uninvited and lonesome, this year through wholesalers and the Ben Franklin Club of San Francisco, an association of manufacturers and agents, a cocktail party was provided for everyone just before the banquet. It was held in the colorful Laurel Court of the hotel, and proved a great social success.

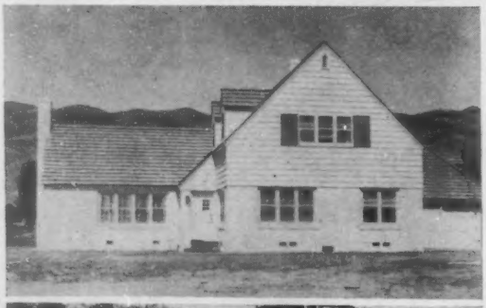
No speeches were programmed for the banquet. Only the golf prize winners were announced briefly. W. P. L'Hommedieu, chairman of the banquet committee, had provided a professional entertainment program of very high order. Stars from some the city's best night clubs appeared in a varied program of dance numbers, dance specialties and parodies, a trick cyclist, an inebriated magician, and in song numbers.

Following the banquet and entertainment, in the terrace ball room, the gold ball room on the main floor was the scene of the final formal ball itself.

Women visitors, wives of delegates, were facilitated in seeing anything they wished to see or were taken on trips as they desired by the ladies' entertainment committee, headed by Harold Q. Noack. Hostesses for the ladies were wives of the chairmen of committees, headed by Mrs. Allen G. Jones, and included Mrs. I. W. Borda, Mrs. J. E. Crilly, Mrs. A. C. Joy, Mrs. W. P. L'Hommedieu, Mrs. Harold Q. Noack, Mrs. Bert W. Reynolds, Mrs. Kenneth M. Ryals, and Mrs. Stanley W. Scarfe.

A greeting committee, of which Kenneth Ryals was chairman, was also a means of spreading acquaintanceship. Registration was handled by the staff of the P.C.E.A. under the direction of I. W. Borda's registration committee. Al C. Joy was chairman of the publicity committee, and J. E. Crilly, of the golf committee.

Two views during construction show location of underwater units



Two methods of pool lighting—Overhead with 9 G. E. ornamental standards; underwater with 27 Westinghouse Aqualux floods 30 in. below water level, 10 ft. apart

Nevada is Electrically Minded

ELECTRICALLY minded is Nevada because electrical contractor-dealers and utility work together to make it so. New homes—even big homes for tax weary people who find Nevada a haven of refuge—have been numerous. Contractors sell homebuilders complete electrification because they live in electric homes themselves and believe in it.

Doing no selling itself, Sierra Pacific Power Co. does stimulate lighting through untiring efforts of Fred W. Steiner, Jr. Even the city engineer at Reno thinks electrically, for when one of its municipal parks was enlarged, a lighted softball field and later a swimming pool were installed. Pictures on this page tell the story. The electrical installations were made by Linnecke Electric Co. for the softball field, Pittsburgh Electric Co. for the swimming pool.

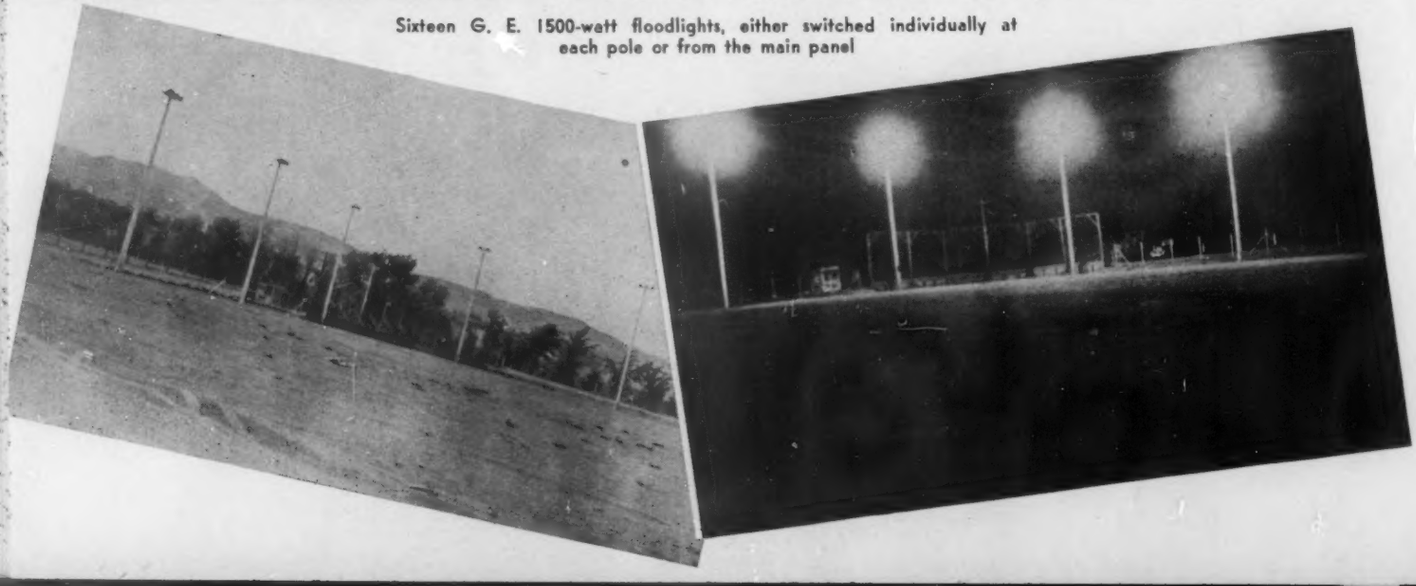
The pool is 50 x 150, with depths from 3 ft. to 10 ft. Spacing of units is increased to 5-ft. intervals from the usual 10-ft. spacing at the deep end. Shower and dressing rooms are equipped with vaporproof Ivanhoe units.

Wiring to the standards on the softball field is brought underground from the main switch to each pole and in conduit to the floodlights. As an added convenience a 60-amp. disconnect switch was mounted on each pole for individual control.

Air conditioning has sold exceptionally well in this region, the contractors handling this type of equipment as well as appliances. Howell Electric Co. of Reno has sold many G. E. installations; H. A. Saviers & Sons, Westinghouse installations, and Nevada Electric & Machinery Co., the Frigidaire jobs.

All-electric homes—Top, in Reno, wired by Linnecke Electric Co., has range, refrigerator, water heater. Center, Electrical Contractor Herbert Smith's own "New American" home in Carson City, complete with everything. Lower, one of the many swank homes on Lake Tahoe; this has a 16.7 kw. range, 3 door refrigerator, 38 kw. in electric heating, 3 15-kw. water heaters; wired by Lyle Smith

Sixteen G. E. 1500-watt floodlights, either switched individually at each pole or from the main panel



NEWS OF THE INDUSTRY

CONGRESS APPROVES FUNDS FOR POWER PROJECTS

Final approval by Congress of the Interior Dept. appropriation bill for the fiscal year 1939 provided funds for a number of Western power projects and amended the Reclamation Act to provide new sources of revenue for the Reclamation Fund.

Direct appropriations included $3,500,000 for construction of Bonneville transmission lines: $3,500,000 for electrical equipment at Boulder Dam, and $24,980,000 from general funds to continue work already started outside of the Reclamation Fund, including Grand Coulee ($13,000,000) and Central Valley ($9,000,000).

To replenish the depleted Reclamation Fund, Congress passed an amendment dedicating to the fund 52½ per cent of the revenues received from the sale of oil from naval reserve lands and providing that receipts from the sale of water and power on reclamation projects built with relief funds shall be covered into the Reclamation Fund—provided that, after the cost allocated to power shall have been amortized, power revenues shall thereafter go into the treasury as general receipts.

P. G. & E. TO FILE FEATHER RIVER BRIEFS BY AUG. 1

Pacific Gas and Electric Company will have until Aug. 1, to file briefs with the Federal Power Commission supporting its application to build six hydroelectric power plants on the North Fork of the Feather River, Calif.

It is the company's contention that this group of projects offers the most efficient and economical source of additional power needed to supply a rapidly growing demand in central and northern California.

The application is opposed by the Central Valley Authority, which contends that development of the plants will create an over-capacity in the region and thus adversely affect the marketing of power from the Central Valley development.

UTAH SUPREME COURT last month denied the petition of Utah Power & Light Co. permanently to restrain the City of Ogden from proceeding with the construction of its proposed $2,600,000 municipal power plant. The ruling reaffirmed previous court decisions.

TENTATIVE RATES for the sale of power to be generated at Seminoe Dam, the major structure of the $20,000,000 Kendrick Federal Reclamation Project, Wyo., have been announced as follows: Firm energy, including a demand charge of $1.25 per kw. of 30-min. maximum demand per month, 6.3 to 7.4 mills per kw.-hr.; firm energy, demand charge waived, 4 to 4.5 mills per kw.-hr.; secondary energy, 1.8 to 2 mills per kw.-hr. The dam will be completed in 1939.

UTAH CONSUMERS GET $400,000 RATE REDUCTION

Electric service rate reductions which will save customers of the Utah Power & Light company approximately $400,000 a year were announced last month following a conference between Public Utilities commission and officials of the company.

The new domestic schedule, effective April 1, replaces all present rate schedules except that for refrigeration service, which is retained temporarily as an optional schedule.*

"Under the new schedule the average residential and farm customer's dollar will purchase 41 per cent more service than in 1934," President G. M. Gadsby asserted. 'The new schedule will result in an average cost of less than 3.5c as compared with the present national average of 4.43 per kw.-hr."

Other major changes to be made as a result of the meeting are: Commercial lighting rates will be reduced July 1. A change in power schedule will be filed whereby the capacity required by the consumer will be measured over a 15-min. interval instead of a 5-min. interval as heretofore. The deferred payment charge on residential and commercial bills will be reduced from 10 to 5 per cent, effective July 1. Time in which residential and farm bills may be paid without addition of the deferred payment charge has been extended to 15 days.

PUBLIC UTILITY DISTRICT No. 2 of Pacific County, Wash., last month filed suit in superior court seeking condemnation and fixing of a purchase price on the Willapa Electric Co.'s power and light facilities serving Raymond and part of the Willapa Valley. Attached to the petition was a resolution by power district commissioners authorizing issuance of $330,000 in revenue bonds with which the district expects to buy the company's holdings.

* ELECTRICAL WEST, February, 1938, p. 80.

ROSS' BONNEVILLE RATE SCHEDULE BEFORE FPC

Administrator J. D. Ross' Bonneville rate schedule was before the Federal Power Commission for approval late last month following a two-week period in which interested parties were asked to submit comments or suggestions. The rates, although considered too high by many, are lower than those at TVA or Tacoma and about equal with that at Boulder Dam.

As submitted, the Bonneville rate structure is based upon a definite charge per kilowatt-year of maximum demand. For delivery at the dam site the rate per kw.-yr. is $14.50 for prime power and $9.50 for secondary. There is also a rate of 2.4c per kw.-day for surplus power. Corresponding rates for delivery at points on the general transmission system are $17.50, $11.50 and 2.88c respectively. The same rate applies to all classes of purchasers: states, municipalities, public bodies, counties, cooperatives, privately-owned utilities and purchasers for industrial consumption.

Prime power is defined as that available 99.5 per cent of the time; secondary power, as all other than can be produced at the plant; surplus power, as power from the project, if available, not definitely under contract. At-site power will not be delivered in quantities of less than 2,500 kw. prime, 1,000 kw. secondary or 1,000 kw. surplus. It will be 13,800 volts, 60-cycle, three-phase. From the transmission system the minimum sale will be 100 kw. in any classification, and the voltage will vary with the localities at the point of delivery. Secondary or surplus power may only be purchased by contractors for prime power.

In calculating the rates, Ross considered the following factors:

1. As announced by the FPC on Feb. 8, 1938 the construction cost of the plant allocated to the initial power installation is $11,682,400. Interest on this investment at 3½ per cent, and amortization in 40 years, gives an annual charge of $547,055.

2. Annual maintenance and operating expenses chargeable to the initial power installation are estimated at $170,680.

3. Estimated cost of the transmission system necessary to carry the output of the first four generators is $14,608,450, with an annual cost including interest, amortization and operating expenses, of $1,242,216 divided as fol-

lows: interest and amortization, $684,-140; ordinary and extraordinary maintenance, supplies and other operating expense, $558,076.

4. Capacity of the plant by the time the transmission system and two additional generators are completed will be 194,400 kw.

Exactly what effect Ross' schedule will have if approved is still a matter for debate. By putting the rates on a kw.-yr. basis he devised what is considered a clever method for attracting continuous process industries: A customer paying the minimum charge of $1,750 per year may use all the electricity desired so long as his demand does not exceed 100 kw. at any time. Portland Chamber of Commerce entered a vigorous protest, however, because, so it claimed, the rates are too high to attract heavy industries.

COINCIDENTAL WITH the rate announcement, Ross divulged plans for an initial transmission system estimated to cost $14,608,450. This would consist of a double circuit 230-kv. transmission line from Bonneville to Vancouver, Wash., and a single circuit line of the same voltage from the dam to Yakima. The estimates also include a double circuit 115-kv. line from Portland to Salem with a single circuit extension to Eugene. Single circuit lines are also proposed from Vancouver to Aberdeen, via Longview and Cathlamet, and from the dam to The Dalles.

●

LAS VEGAS, NEV., city commissioners last month voted unanimously to reject PWA's offer to finance construction of a $250,000 municipal power plant and distributing system.

●

PRELIMINARY CONFERENCE on the Wyoming-Montana compact for division of the waters of Yellowstone River was held in Billings, Mont., last month by Clyde L. Seavey, acting chairman of the FPC; John R. Quinn, state engineer representing Wyoming, and E. B. Donohue, chief engineer of the State Water Conservation Board of Montana.

●

PORTLAND GENERAL ELECTRIC CO. is spending $112,800 for service improvements including 24,000-volt transmission line and 11,000-volt line in Canby, Woodburn and Mt. Angel, Ore.

●

PACIFIC GAS AND ELECTRIC CO. last month set what is believed to be a precedent among major electric light and power companies when it published a report to employees on company business in employee language. The report, by President James B. Black, was essentially a digest of the stockholders' report previously issued.

Northwest Assn. Accountants Study Problems at Spokane

Application of tabulating machines to three branches of utility accounting and an improved method of handling customers on the floor of the utility office and by phone were major considerations at the thirteenth annual meeting of the Accounting & Business Practice Section, Northwest Electric Light & Power Assn., in Spokane. Machine accounting as applied to the general ledger in the B. C. Electric Railway Co. was explained from a chart by S. A. Horner of that company. T. L. Doran, Montana Power Co., and J. H. Clawson, Puget Sound Power & Light Co., explained the methods of using machines in their companies for billing customers and payroll accounting.

The routine system by which Washington Water Power Co. handles the business of all customers calling at the office or telephoning to the company was fully illustrated and demonstrated by J. E. Winton, head of the customer service department. All customers calling at the office are met by service representatives at desks on the ground floor, Winton said. Information as to duplicate bills, service locations in the city, customer's credit and any other needed data from the files upstairs are handled over a loud speaker system. Two essential elements in the system are mechanical equipment and employee training.

Analysis of the prudent investment theory of valuating utility property was presented by Alan G. Paine of the law firm, Post, Russell, Davis & Paine, Spokane. Eric A. Johnston, director of the U. S. Chamber of Commerce, also of Spokane, presented "Some New Thoughts on the Present Day's Muddled Situation." The meeting closed with a round table discussion, led by R. H. Jones, Utah Power & Light Co., of points raised by the members relative to the classification of accounts. In charge of the two-day session was C. E. Gieseker, Washington Water Power Co., chairman.

●

OUTSTANDING ACTS of courage and devotion to duty by employees of electric light and power companies in the maintenance of electric service under adverse conditions will be recognized nationally through the establishment of the Claude L. Matthews Awards for Valor. The awards, consisting of three prizes of $150 each, cover acts of valor performed during 1938. They will be administered by the prize awards committee of the Edison Electric Institute.

HOUSE OF REPRESENTATIVES last month passed a bill authorizing the installation of electric generating machinery at Fort Peck Dam, Mont., as rapidly as a market for power can be developed. Ultimate cost will be $6,800,000. Following the pattern established at Bonneville, the House also amended the Senate bill by dividing control of the project between the Army Engineers, who will be in charge of construction, maintenance and operation, and the Bureau of Reclamation, in charge of power distribution.

●

California Snows Melt Slowly; Rivers Run High

Because of the heavy snow pack still remaining in the Sierras last month, California's main snow-fed rivers will run at stages higher than usual until well into the summer, the California Cooperative Snow Surveys announced last month. Low water flow of the late summer and autumn will be greater than for many years.

As of May 10, in the northern Sierra over one-third of the snow had melted below 6.500 ft.; from 10 to 20 per cent, in the 6,500-7,500 zone, and 5 per cent, above 7,500. South from Tuolumne, 40 per cent had run off below 6,500; 25 per cent, between 6,500 and 8,500, and very little, above 8,500. In the Kern basin the survey at Round Meadow at 9,000 ft. indicated a reduction of 39 per cent.

●

LA JUNTA, COLO., taxpayers voted 691 to 559 last month to issue $497,000 in revenue bonds to build a municipal electric light plant.

●

PACIFIC POWER & LIGHT CO. is to start construction of a $60,000 subdistrict power station at Yakima, Wash. The station, to be served with an 11,000-volt feeder from the Union Gap substation, will be of the outdoor type.

●

ANNUAL MEETING of the Rocky Mountain Electrical League will be held at the Canyon Hotel, Yellowstone Park Aug. 29-31.

●

WATER IMPOUNDED by Boulder Dam in Lake Mead last month reached 16,000,-000 acre-ft., enough to cover the states of Massachusetts and Connecticut to a depth of two feet. At the present water level a head of 469 ft. is provided for the five generators at the toe of the dam.

●

MOHAVE COUNTY, Ariz., is expecting a mining boom when cheap Boulder power reaches Kingman this October. Built by Citizens Utilities Co., the line plus equipment will cost about $400,000.

GROSS OPERATING REVENUES of San Diego Consolidated Gas & Electric Co. for the year ending Feb. 28 amounted to $8,067,038 as compared with $8,060,374 for the previous year.

●

GROSS OPERATING REVENUES of Pacific Gas and Electric Co. for the year ending March 31 totaled $100,864,803 as compared with $97,080,257 for 1937.

●

GROSS OPERATING REVENUES of Southern California Edison Co. for the year ending March 31 totaled $42,655,450 as compared with $42,290,290 for the previous year.

●

GROSS OPERATING REVENUES of Mountain States Power Co. for the year ending Feb. 28 totaled $4,131,786 as compared with $3,711,110 for the corresponding period 1937.

●

GROSS OPERATING REVENUES of Southern Colorado Power Co. for the year ending March 31 totaled $2,334,489 as compared with $2,262,582 for the previous year.

●

GROSS OPERATING REVENUES of British Columbia Power Corp., Ltd., for March amounted to $1,269,358 as compared with $1,272,169 in March 1937.

●

INDUSTRIAL HEATING COURSE, conducted by E. J. Cipperly at the new General Electric building, Los Angeles, was started last month by the Electrical Maintenance Engineers Assn. of Southern California. The five meetings, to be held on alternate Tuesdays from 7:30 to 9:30 p.m., were limited to 100 members.

●

MANY DIFFERENT PHASES of rural electrification will be discussed at the annual convention of the American Society of Agricultural Engineers June 27-30 at Asilomar, Pacific Grove, Calif.

●

INTERNATIONAL BROTHERHOOD OF ELECTRICAL WORKERS, Local 659, Medford, Ore., has inaugurated an educational program to improve the members' understanding of California-Oregon Power Co.'s service, marketing methods, departmental functions, etc.

●

REA Activities

JEFFERSON VALLEY RURAL ELECTRIC COOPERATIVE, INC., Whitehall, Mont., has received an allotment of $3,000 to complete the project.

BLACHLY-LANE COUNTY COOPERATIVE ELECTRIC ASSN., Blachly, Ore., has received an allotment of $9,000 to complete the project.

LOURDES VALLEY POWER CO. has started work on construction of an $8,000 line to serve farmers east of Harrington, Wash. Power will be furnished by Washington Water Power Co.

"KIDNAPPED KURRENT"

(polyphase style)

Each case of polyphase current diversion is expensive. If polyphase diversion was as prevalent as single phase — oh my!

Those big revenue polyphase meters of yours, ALL OF THEM, deserve proper protection from dirt, deviltry and diversion.

Superior polyphase Overall Meter Enclosures will protect those meters.

Write for Bulletin No. 379

Superior Switchboard & Devices Company

CANTON, OHIO

*Been at it Since 1920

SUPERIOR

REG. U. S. PAT. OFF.

INLAND EMPIRE RURAL ELECTRIFICATION ASSN., Spokane, has awarded a contract to Fritz Ziebarth, Long Beach, Calif., for constructing third unit of project, 175 mi. of line in Whitman County. $146,230.

CONTRACT BETWEEN Clearwater Valley Light & Power Assn., Lewiston, Ida., and Washington Water Power Co. for the sale of power to the former by the latter at its regularly filed REA rate was approved last month. The association will take energy at 11,400 volts at the utility's Juliaetta substation.

PLUMAS SIERRA RURAL ELECTRIC COOPERATIVE, Blairsden, Calif., has awarded a contract to Duncan Electric Co., Lafayette, Ind., for supplying 675 meters. Bid was $7,468. Meanwhile Fritz Ziebarth, Long Beach, has started work on construction of the 229-mi. project.

ACCEPTANCE BY REA of the bid of NePage McKenny Co., Seattle, for construction of Quinault Light Co.'s line near Lake Quinault, Wash., was reported last month. Decision on copper or aluminum wire was not made. NePage McKenny bid $25,707 for aluminum; $26,252 for copper.

●

Contracts Awarded

BY BUREAU OF RECLAMATION for pipe fittings, valves, appurtenances for Grand Coulee Project to Koppers Co., Western Gas Div., Fort Wayne, Ind., $39,092; G. B. Limbert & Co., Chicago, $128,143; R. Hardesty Mfg. Co., Denver, $33,014; California Steel Products Co., San Francisco, $299; Midwest Piping & Supply Co., St. Louis, $18,298.

BY SEATTLE BOARD OF PUBLIC WORKS to Fritz Ziebarth, Long Beach, for stringing six transmission lines and ground lines over 116-mi. route between Gorge power plant and South receiving substation. $165,800.

BY DEPARTMENT OF INTERIOR, office of Indian Affairs, to Fairbanks-Morse & Co., Los Angeles, for generator unit for power plant, Window Rock, Ariz. $18,928.

BY BUREAU OF RECLAMATION for 43 ring-seal gates on outlets at Grand Coulee Dam and power penstocks at Seminoe Dam, Wyo., to Consolidated Steel Corp., Los Angeles; $1,089,937. For 40 ring-seal gates for Grand Coulee to Joshua Hendy Iron Works, San Francisco; $854,163. For conduit lining needed in outlet works at Grand Coulee to U. S. Foundry Co., East Burlington, N. J.; $178,089.

TO FARR, ROBINSON & BIRD, LTD., Vancouver, B. C., for furnishing lighting fixtures for the $12,000,000 hotel now being built in Vancouver for the Canadian Pacific and Canadian National railroads.

BY SEATTLE BOARD OF PUBLIC WORKS to Industrial Electric Co., Seattle, for installation of electric machinery in Seattle City Light's South receiving substation. $79,117.

TO VAN S. MCKENNY CO., Seattle, for installation of a floodlighting system in Seattle's Pacific Coast League baseball park. Project involves 200 1,500-watt units, producing 50 ft.-candles on the infield area and 30 ft.-candles on the outfield, installed in banks on four steel towers and four two-pole wood structures.

TO VAN S. MCKENNY CO., Seattle, for installation of an ornamental lighting system on Wetmore Ave., Everett, Wash. $7,139.

ABOUT PEOPLE

Committee Personnel Named For AIEE Convention

Committee personnel has been completed for the combined summer and Pacific Coast conventions of the AIEE to be held at the Fairmont Hotel, San Francisco, during the week of June 26, 1939. The AIEE chose this date rather than participate in the joint convention to be held during the week of June 10 by the ASCE, ASME and AIM&ME.

S. J. Lisberger, Pacific Gas and Electric Co., is general convention chairman; D. I. Cone, Pac. Tel. & Tel. Co., vice-chairman. R. O. Brosemer, General Electric Co. is treasurer and George C. Tenney, ELECTRICAL WEST, secretary of the general committee. Sub-committee chairmen are: Hotel—E. A. Crellin, Pacific Gas and Electric Co.; program—W. C. Smith, General Electric Co.; reception and entertainment—A. W. Copley, Westinghouse Elec. & Mfg. Co.; registration—M. S. Barnes, General Electric Co.; sports—R. J. Cobban, Westinghouse Elec. & Mfg. Co.; trips and local transportation—F. R. George, Pacific Gas and Electric Co.; student activities—H. H. Skilling, Stanford University; transportation—Stanley Rapp, Pac. Tel. & Tel. Co.; publicity—J. S. Moulton, Pacific Gas and Electric Co.

●

C. J. WHITE

C. J. WHITE, Pacific Coast representative for Tork Clock Co. for ten years prior to going east in 1933, has been elected president of the company.

●

E. N. HORSEY, B. C. Electric Railway Co.'s resident engineer at Victoria, has been appointed manager of the company's light and power division on Vancouver Island. He succeeds the late S. J. Halls. E. G. Hart, a member of the Victoria engineering staff, replaces Horsey.

H. C. GARDETT, chief of the design construction department of the Los Angeles Bureau of Power and Light, has been advanced to the position of assistant chief electrical engineer and general manager. In this position he will retain his former responsibilities for design and construction but will be relieved of much detail. Mr. Gardett is a graduate of the University of California. He joined the Power Bureau when the Owens River project was first under construction. He worked on design and construction on that project and when his present department was organized in 1917, he was placed in charge.

●

Central Valley Setup Is Altered by Ickes

Preparing for commencement of large-scale construction, Secretary of Interior Ickes last month announced a modification of the administrative setup of the Bureau of Reclamation Central Valley Project in California.

Ralph Lowry, director and construction engineer of the Boulder Canyon project since 1935, has been transferred to the Central Valleys project as construction engineer of Shasta Dam. He will report on strictly engineering matters to Chief Engineer Raymond F. Walter, Denver.

Roy M. Snell, resident engineer in charge of the Kennett Division of the project, is principal assistant to Lowry. Walker R. Young continues in charge of the entire project.

Bids on Shasta Dam construction were to be opened at Sacramento, June 1.

●

J. T. LUSIGNAN JR., former engineering assistant to the vice-president has been appointed executive engineer of the Ohio Brass Co. He is well known on the West Coast for his work in the high voltage laboratory at Stanford.

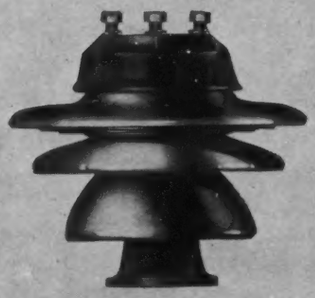
●

PERRY O. CRAWFORD, former vice-president and general manager of California-Oregon Power Co., has resigned as president of American Utilities Service Corp., Chicago, to become vice-president of Central Service Corp., public utility consultants to American Utilities subsidiaries.

●

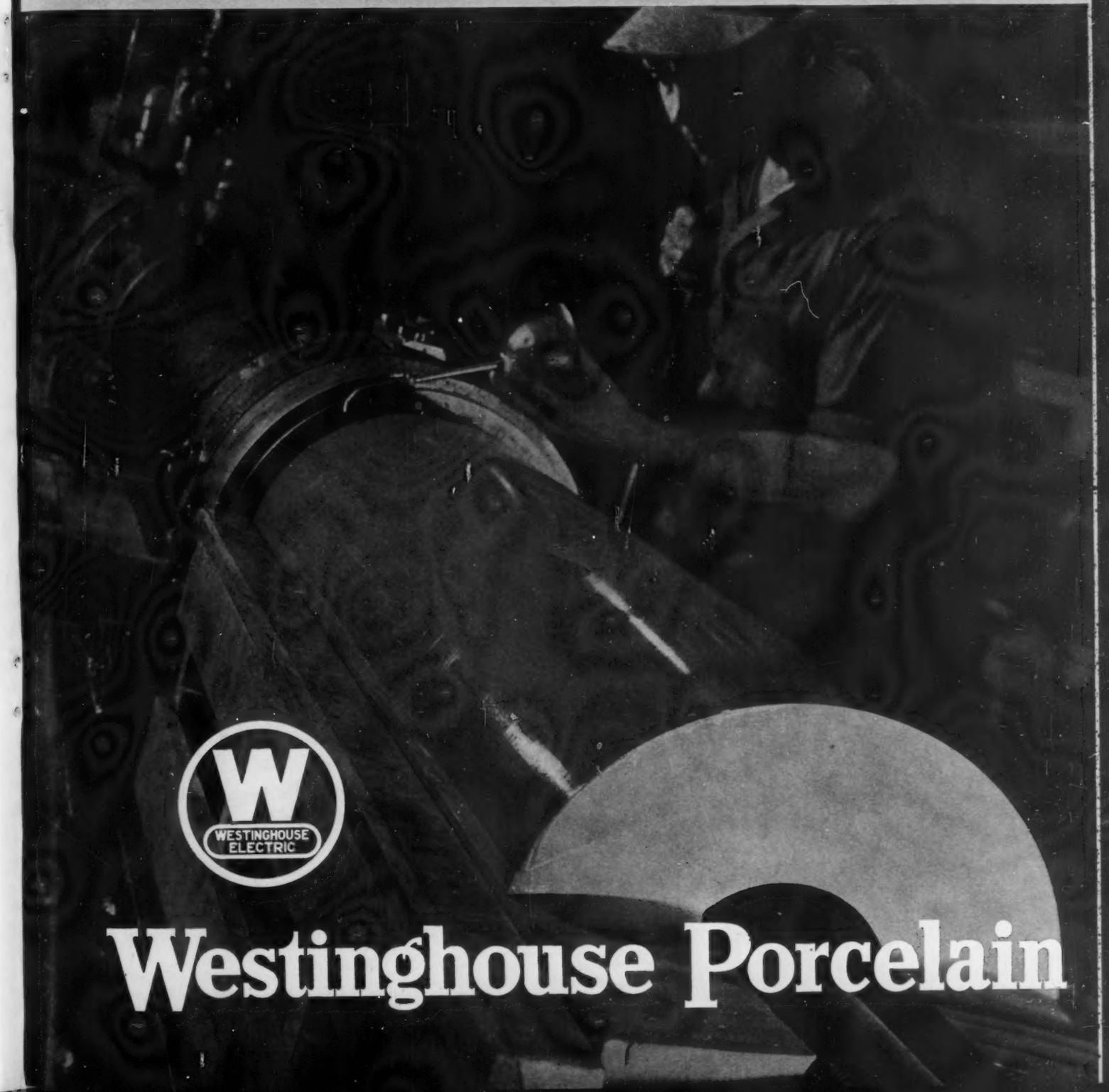
WILLIAM B. BRUERE, consulting engineer on loadbuilding and electric heating for the TVA, has joined Portland General Electric Co. in a similar capacity. "Immediate main objective (of the move)," said Bruere, "is to encourage electric heating as an auxiliary to other heating systems in the home, especially bathrooms and other small rooms."

Perfection IN EVERY PIECE • • • LARGE OR SMALL



Velvet-fine—like the smoothest face powder . . . entirely free from laminations . . . smooth — like polished glass . . . such is the texture of these huge Westinghouse porcelain bushings. Vacuum pugged and extruded under terrific pressure, the unfinished porcelain is air-free and extremely dense. Westinghouse porcelain bushings, like this one, are preferred by manufacturers of all types of electrical equipment because the porcelain produced by this special process is of the highest quality obtainable. Whether your requirements include 4-ounce low-voltage pin type insulators or these 1000-pound bushings, you will find a Westinghouse porcelain product to meet your exact needs. When you next order porcelain, be sure to specify Westinghouse. More than 120 stocking points assure overnight service anywhere in the United States. The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Penn. Porcelain Factories in Derry, Penn., and Emeryville, California.

J-05019



Westinghouse Porcelain

C. B. Jarvis Elected Head of Vancouver Association

Cale B. Jarvis, in charge of the operations of Jarvis Electric & Refrigeration Co., has been elected president of the Vancouver Electrical Assn., succeeding T. C. Simmons. He will continue as editor of the association's official journal, "The Electric Eye."

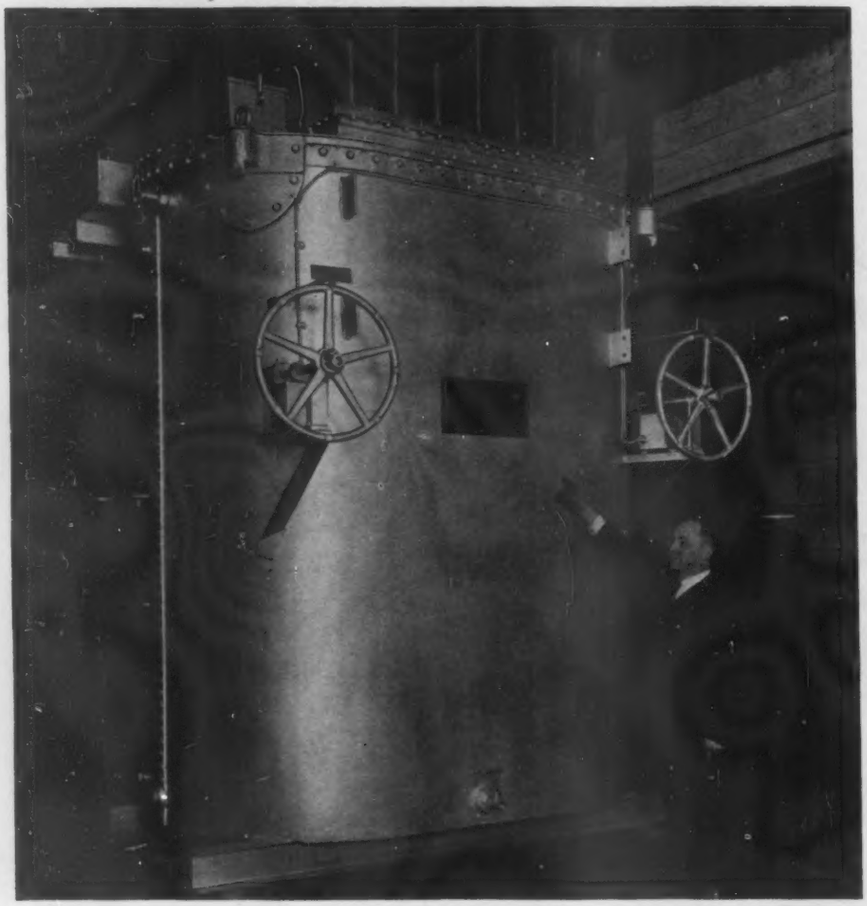
J. B. Homersham, Central Electric, has been elected vice-president; S. F. Ricketts is secretary, and George W. Firth, treasurer.

In addition to these officers, the executive committee includes R. Hall, J. H. Carmichael, R. G. Wallace, J. H. McRae, R. A. Graham and Earle Dunsmuir.

●

GEORGE TAAFFE, Valley Electrical Supply Co. salesman at Paso Robles, Calif., has been transferred to Fresno to succeed Ted Boyd who resigned recently. Richard Wilkins, West Fresno, replaces Taaffe; J. D. LaBonte, Fresno city territory, replaces Wilkins. L. E. Wilcox, San Luis Obispo, succeeds LaBonte; Henry Diel, assistant to R. W. Downing in Fresno, transfers to San Luis Obispo.

CUSTOM-BUILT DEPENDABILITY!



• Experienced Gardner transformer engineers met the specific requirements of the U. S. Bureau of Mines in the experimental furnace installation at Boulder City, Nevada. For the past year, this 1500 kva. 3-phase furnace transformer with taps, changer, and built-in reactor has performed economically and efficiently.
• See our nearest representative for complete details on Gardner standard or special transformers—the choice of leading western concerns for over a quarter of a century.

GARDNER ELECTRIC MFG. CO.
4227 Hollis Street Emeryville, California

REPRESENTATIVES: Geo. E. Henn Co., 420 Market St., San Francisco, Calif.; Beeson Engineering Co., 2501 E. 52nd St., Los Angeles, Calif.; Industrial Electric Co., 1304 Stewart St., Seattle, Wash.; Modern Electric Co., 57 Richards St., Salt Lake City, Utah; Kranefeld Engineering Co, 3416 14th Ave., Denver, Colo.

FOUR SECTIONS of the American Institute of Electrical Engineers have elected chairmen for 1938-39. They are: Portland — Charles B. Carpenter, Pacific Telephone & Telegraph Co.;San Francisco—F. S. Benson, Pacific Gas and Electric Co.; Los Angeles—David Hall, Westinghouse Electric & Mfg. Co.; Seattle—Roy E. Kistler, Pacific Tel. & Tel.

●

DEALER ASSOCIATIONS have been formed in two Montana cities to take advantage of the promotion and cooperative assistance offered by Montana Power Co. Heading the Butte Appliance Assn. are M. L. Fleming, Ellis Paint Co.; C. M. Gillespie, Hennessy Co., and George Steele, Maytag Shop. Heading the Billings Appliance Dealers' Assn. are E. C. Myers, Billings Norge Co., president; A. R. Morgan, Rafn Morgan Electric Co., vice-president, and Charles Stroup Jr., Stroup Hardware Co., secretary.

●

ROBERT S. PRUSSIA has been made district representative for the Sight Light Corporation covering the territory from the Mississippi River West. Another showman who entered the lighting business, Mr. Prussia has been identified in the past with Westinghouse Lamp Company and more recently with the C. W. Cole Company of Los Angeles.

●

JAMES B. BLACK, president of Pacific Gas and Electric Co., and W. C. Mullendore, vice-president of Southern California Edison Co., are included among the list of Western industrialists sponsoring the Pacific Coast Manufacturers' Conference in San Francisco June 7-8.

●

KENNETH GRAFF, General Electric Supply Co. salesman, San Francisco, was last month transferred to the Fresno branch.

●

HARRY GERSTER, merchandising manager of the General Electric Supply Corp.'s San Francisco office, headed a group of twenty G.E. vacuum cleaner agents in his territory who qualified for a month' strip to the Hawaiian Islands by attaining their quotas in a selling campaign.

●

CHARLES LANGE, Northeast division, and Harry White, Spokane division, were first prize winners in Washington Water Power Co.'s 6-month commerial light conditioning campaign. William Ormsby, Palouse, and Gordon DeFoe, Spokane, were runners-up.

●

WALLACE L. WARE, president of the California Railroad Commission, has resigned in order to re-enter the private practice of law in San Francisco.

Hugh M. Crawford Dies of Heart Attack May 29

Hugh M. Crawford, 53, general sales manager of Pacific Gas and Electric Co., died of heart attack, May 29, while at his summer cabin on the Russian River, Calif.

Born in Newcastle, Pa., Mr. Crawford graduated from University of Nebraska, then worked with a construction firm in Pittsburgh. He came to California 25 years ago to construct the Glenn County project of the Sacramento Valley Irrigation Co. This finished, he became commercial manager for San Joaquin Light & Power Co. at Bakersfield and 20 years ago joined P. G. & E. In 1925 he was made general sales manager.

In association affairs he was active, though he always preferred the background—even as he did in his company, developing his associates by a democratic delegation of responsibility and reward. No sales executive in the industry ever used the conference method for developing plans so thoroughly as did Mr. Crawford. A student of salesmanship, he was also a teacher for a course conducted by the University of California extension division. He was a past president of the Pacific Coast Gas Assn., chairman of the commercial section and of the guidance committees of the PCEA and was active in the Sales Managers Assn.

The Basic Ingredient of "PRUDENT MODERNIZATION"

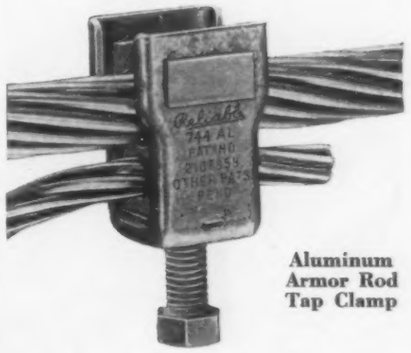
"We should never forget that the quality and attractiveness of the service we have to sell depends upon

...THE DESIGN AND EFFICIENCY OF THE EQUIPMENT FOR THE GENERATION, DISTRIBUTION AND CONSUMPTION OF THAT SERVICE"

President C. W. Kellogg before the Sales Conference of Edison Electric Institute

● SINCE 1896 - ELECTRICAL TESTING LABORATORIES
(NEW YORK CITY - EAST END AVE. AT 79th ST.)
HAS CO-OPERATED WITH MANUFACTURERS AND UTILITIES TO THE END THAT THIS QUALITY AND ATTRACTIVENESS MAY CONTINUE TO CHARACTERIZE CENTRAL STATION SERVICE.

Specify Reliable CONNECTORS For RED OR WHITE CONDUCTORS



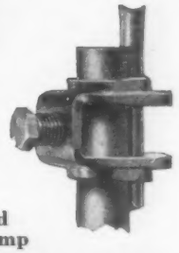
Aluminum Armor Rod Tap Clamp

Aluminum to Copper Connector

Type A Copper-weld Straightline Splice

Splicing Sleeve

Copper Wire Solderless Connector



Ground Rod Clamp

Reliable ELECTRIC COMPANY
OVER 25 YEARS SERVICE TO THE UTILITIES
3145 CARROLL AVENUE - CHICAGO ILLINOIS

Shown above is the individual container and larger shipping carton.

SAFEGUARDING
YOUR INVESTMENT IN KORTICK POLE LINE HARDWARE

● KORTICK SCORES again. Pioneers a new idea for packaging dead end Clevises—reduces breakage—makes handling easier in stock room and out on the job.

Each Kortick dead end Clevis is individually packed in corrugated cardboard containers and then neatly stacked in a larger cardboard carton for shipping. Kortick saves you money by eliminating the ordinary barrel or box and excelsior packing with its high percentage of broken items and its difficulties in storaging and handling. In its place you get the neat individual container that is safer and easier to handle.

For complete details write or call us today.

KORTICK
MANUFACTURING CO.

MAIN OFFICE—
PLANT, WAREHOUSE
345 First St., San Francisco, Calif.
Telephone GArfield 8080

Complete warehouse stocks also at
LOS ANGELES, PORTLAND,
SEATTLE

LINCOLN DEMAND METERS

THE *correct* PRINCIPLE

Type CCW Graphic Demand Meter

The capacity of generation and distribution equipment is directly related to the heating effect of the load imposed. Likewise the registration of the Lincoln Maximum Demand Meter depends upon the heating effect of the load.

LINCOLN METER COMPANY
SPRINGFIELD, ILLINOIS

Victoria Electrical Assn. Elects R. T. Murphy

R. T. Murphy, head of Murphy Electric, has been elected president of the Victoria (B. C.) Electrical Assn. A. Whiteman, Oak Bay Electric, is vice-president, and A. R. Colby, MacDonald Electric, secretary-treasurer.

Executive committee members are: E. Cox, George MacDonald; E. Emery, H. J. Langdon and E. P. Saunders. C. Ireland and Emery were appointed auditors.

●

W. E. STEPHENS, who receives his doctor's degree from California Institute of Technology for research in nuclear physics this year, is one of the first five Westinghouse Research Fellows who have been selected for work in fundamental science at the Westinghouse Research laboratories in East Pittsburgh. Under the plan Westinghouse will support the work of ten young physicists on fundamental studies broadly related to the electrical industry.

●

ELECTRIC CLUB of Washington's fifteenth annual golf tournament was to be held at Sand Point Golf & Country Club June 6, Walter D. McDonald, temporary golf chairman, announced last month. Grover C. Burke was in charge of arrangements for the banquet and subsequent entertainment.

●

C. M. RYAN has been placed in charge of the major electric appliance department of Olds, Wortman & King, Portland.

●

GEORGE T. BRAGG, vice-president and general manager, Pacific Power & Light Co., and Gertrude Humphrey, secretary to Vice-President L. A. McArthur, have been awarded 20-year service pins.

●

THROUGH A CHANGE in bylaws increasing the number of elected directors to eighteen, three vacancies on the directorate of the Pacific Coast Electrical Assn. were filled at a recent board meeting. K. A. Ryals, Stone-Ryals Electric Co., San Francisco (contractor); F. J. Airey, F. J. Airey Co., Los Angeles, (manufacturers' representative), and M. H. Jankelson, Incandescent Supply Co., San Francisco (wholesaler) are the new directors.

●

W. H. PARK, manager of industrial sales, Pacific Gas and Electric Co., has been elected to the California CREA.

●

M. D. THOMPSON, Spokane, has been placed in charge of the major appliance department of Robert Bros., Portland.

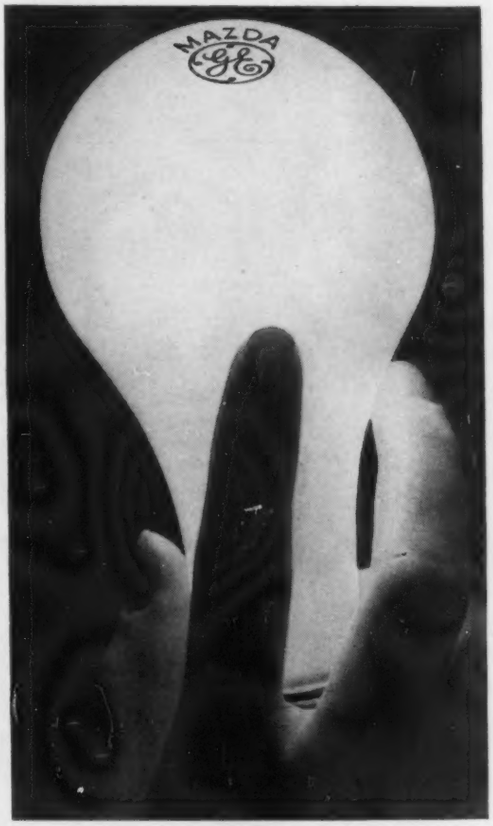
All set to go! . . . G-E READY TO LAUNCH BIGGEST PROMOTIONAL CAMPAIGN IN LIGHTING HISTORY

Light Conditioning is theme for concentrated fall activity on Better Light-Better Sight

IN the interests of further developing the principle of Better Light-Better Sight, General Electric plans the biggest concentrated promotional campaign ever staged during the fall lighting season.

Plans for this activity have already been perfected. Tying in with the theme "Light Conditioning" is an entirely new plan developed by General Electric for enlisting retail lamp dealers in the program. This embraces the creation of "light conditioning dealers" who will be able to recommend the right size lamp bulb for every lighting need . . . and so offer a light conditioning service.

These light conditioning dealers will be developed from enterprising G-E lamp agents who will be given a special course of training to qualify them as light conditioning specialists. In addition, they will be supplied with special information, materials, and adequate lamp stocks to enable them to offer a light conditioning service. Supporting this lighting program will be a concentrated magazine advertising campaign including nine full pages . . . a page a week . . . in the *Saturday Evening Post.* Seven full pages in *Collier's.* And six full pages in *Liberty.* These ads will all appear within a sixty days' period, beginning September 15th and running through November 15th.



Co-ordinated newspaper advertising also planned

In addition, there will be concentrated newspaper advertising campaigns in many of the major cities of the country to coordinate with utilities' own fall lighting campaigns.

This light conditioning dealer program plus the magazine and newspaper advertising campaigns will reach more people with lamp and lighting messages during the important fall lighting season than ever before in so concentrated a period.

. . .

Complete plans, information, advertising mats, and a wealth of material for tying in with and promoting the idea of light conditioning for Better Light-Better Sight this fall are available to utilities. For further information, write your nearest General Electric lamp division office.

GENERAL ELECTRIC

INCANDESCENT LAMP DEPARTMENT, NELA PARK, CLEVELAND, OHIO

Giving the KIND OF SERVICE UTILITIES WANT

JOSLYN POLE LINE HARDWARE MEETS WESTERN NEEDS FOR LONG LIFE AND RELIABILITY

● When installing Joslyn pole line hardware, experience tells utility engineers that their lines will last longer. There will be less need of frequent repairing and replacement costs will be lowered. For Joslyn hardware is designed to stand up under long tough usage.

Let us supply your needs too. Whether it be transmission, distribution, electrical equipment or construction materials, Joslyn can give quick efficient service.

JOSLYN COMPANY

OF CALIFORNIA

FACTORY: 5100 DISTRICT BOULEVARD, LOS ANGELES, CALIFORNIA
DISTRICT OFFICE: 180 POTRERO AVENUE, SAN FRANCISCO, CALIFORNIA

GEO. E. HONN CO.

420 MARKET STREET SAN FRANCISCO, CALIF.

Gives Quick Service on Quality Products from Local Stocks

MANUFACTURERS' REPRESENTATIVES FOR:

PYREX INSULATORS
BREWER-TITCHENER HARDWARE
● Corning Glass Works

FUSES, CUTOUTS, DISCONNECTS, PROTECTIVE DEVICES
● Schweitzer & Conrad, Inc.

CAPACITORS
● Cornell-Dubilier Corp. World's Largest Exclusive Mfrs. of Capacitors

TRANSFORMERS
● Gardner Electric Mfg. Co. Power and Distribution Transformers
● Lee Skipwith & Co., Inc. Niagara Air-Insulated Current Transformers

CABLE GRIPS
● Kellems Products, Inc.

CONNECTORS, GROUND ROD CLAMPS, UTILITY HOISTS
● Jasper Blackburn Products Corp.

GROUND LINE POLE TREATMENT
● Osmose Corp. of America

METERING INSTRUMENTS
● Landis & Gyr, Inc.

CROMPTON TONG TEST AMMETER
● Columbia Electric Mfg. Co.

UNDERGROUND TOOLS AND EQUIPMENT
● T. J. Cope, Incorporated

TREE TRIMMING EQUIPMENT
● Bartlett Manufacturing Co.

FRICTION AND RUBBER TAPES
● Clifton Manufacturing Co.

R. J. FRANKS has been elected chairman of the adequate wiring bureau organized by Spokane electrical contractors, wholesalers, contractor-dealers and utility executives. Charles H. Barret is vice-chairman. H. C. Bender, secretary-treasurer, will be in charge of Washington Water Power Co.'s participation in adequate wiring promotion.

●

C. H. KAUFMAN last month won the annual golf tournament of the Ben Franklin Club, Los Angeles, with a low net of 64. H. D. Hawks won low gross for members; Jack Bissitt and C. H. Thrane, low gross for guests; F. A. Twoomey, low net for guests, and George Cederlof, high gross. Blind bogey winners were J. L. Cook, first; Frank Sarson, second, and Paul Mullenbach, third.

●

D. W. RENNEWANZ, Pacific Power & Light Co.'s chief salesman at Sunnyside, Wash., has joined Edison General Electric Appliance Co. He is succeeded by John Kingman, chief salesman at Dayton, Wash., who is succeeded by Jack Kelly of the Yakima sales force.

●

ROY BUTCHER, San Jose, Calif., electrical contractor, and chairman of the Contractors' State License Board, has been reappointed to the board for another 4-yr. term.

●

EARLE DUNSMUIR has purchased the business of Radio & Television Engineers, Vancouver, and merged it with his recently established contracting business.

●

JACK COOPER, in charge of Canadian General Electric Co.'s radio sales division in British Columbia, has been elected president of the Radio & Electrical Appliance Distributors Assn. at Vancouver.

●

JOHN J. COOPER has retired from Bacon-Cooper Co., Denver distributor.

●

NEW HOME SERVICE DEPARTMENT staff of Valley Electrical Supply Co., Fresno, Calif., consists of Alice Hetzel, director, and formerly in charge of dealer cooperative demonstrations; Vivian Glines, Helen Gottschalk and Luretta Usner.

●

RAY MARS has been placed in charge of the small electric appliance department of Lipman Wolfe & Co., Portland.

●

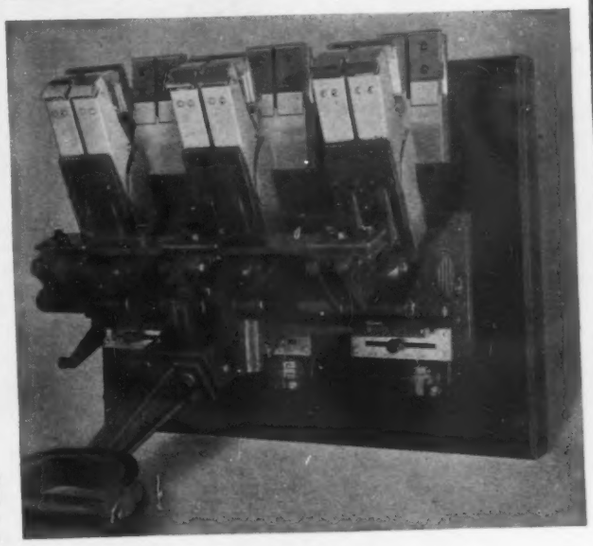
F. J. BARTHOLOMEW, Vancouver, B. C., engineer engaged by the City of Vernon, B. C., to conduct power rate negotiations with the West Canadian Hydroelectric Corp., Ltd., last year, has been asked to make a survey of Vernon's street lighting system.

AIR CIRCUIT BREAKERS

I-T-E Circuit Breakers of the carbon break type are listed as standard in capacities ranging from 2 to 10000 amperes and for use on voltages up to and including 750 volts. Special circuit breakers have been manufactured with capacities up to 54000 amperes at 750 volts, direct current.

Remote control circuit breakers operated by solenoid or motor are available in all capacities. I-T-E also manufactures a complete line of hand and remote control transfer switches and field switches, as well as laminated toggle switches.

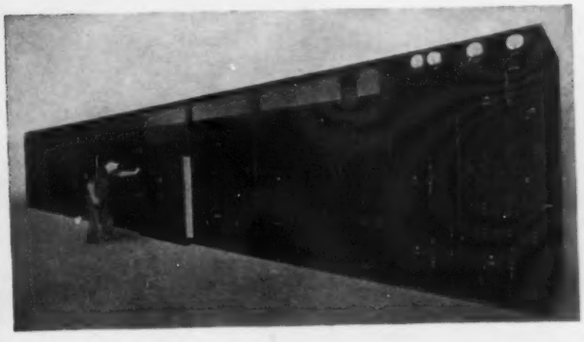
Special problems in electrical protection are given immediate attention by our engineers.



ITELITE CIRCUIT BREAKERS OF THE THERMAL TYPE

ITELITE circuit breakers are thermally operated breakers designed to eliminate fuse replacement in protecting power and lighting circuits. They are available in capacities suitable for the protection of all commercial wire sizes from 15 to 600 amperes and for voltages up to 250 volts direct current and 600 volts alternating current.

The ITELITE line includes single, double and three pole circuit breakers suitable for mounting in lighting panelboards, in convertible power panels, in load centers, on switchboards or in special enclosures for industrial purposes.



MULTUMITE SWITCHBOARDS

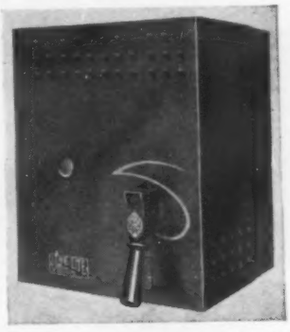
Multumites are self-supporting steel enclosed switchboards—every live part including buses, enclosed in steel—of the most modern construction. Circuit breakers are mounted rigidly in position or on pantograph arms for easy disconnection and removal. Large circuit breakers can be mounted in removable trucks and incorporated in multumite units.

Multumite switchboards protect and control circuits from 2 to 4000 amperes up to 600 volts, alternating current and 2 to 10000 amperes at 750 volts direct current.

U-RE-LITE CIRCUIT BREAKERS

U-Re-Lites are steel enclosed air circuit breakers, especially adapted to the protection of motors and motor circuits. U-Re-Lite capacities range from 2 to 1600 amperes at 250 volts D. C. and up to 600 volts A. C. Standard U-Re-Lite boxes provide for all usual methods of mounting and connection. Special boxes can be furnished to make U-Re-Lites dust-proof and moisture-proof.

Type KJB, KSB and KWB Circuit Breakers are compact solenoid operated air circuit breakers in steel enclosures. These circuit breakers are available in single and multiple pole types with capacities of 2 to 800 amperes, 250 volts, D. C. or up to 600 volts A. C.



Descriptive literature and quotations on all I-T-E devices can be obtained from representatives listed below or from the I-T-E factory

San Francisco, Cal. . . . 74 New Montgomery St. . . . Oliver B. Lyman — E. S. Moreland
Los Angeles, California . . . . . 106 W. Third Street . . . . . Otto Demmert
Denver, Colorado . . . . . 1921 Blake Street . . . . . Howard Peterson
Seattle, Washington . . . . . 902 33rd Avenue . . . . . Burton R. Stare
Vancouver, British Columbia . . . 622 Metropolitan Building . . . N. D. Blagdon Phillips

I-T-E CIRCUIT BREAKER CO. • PHILADELPHIA

MAYDWELL & HARTZELL
INCORPORATED

Engineers
AND
Manufacturers' Representatives

☆ ELECTRICAL TRANSMISSION AND DISTRIBUTION LINE MATERIALS

☆ TELEPHONE AND TELEGRAPH LINE MATERIALS

☆ STEEL PRODUCTS

SAN FRANCISCO — 158 Eleventh Street
LOS ANGELES — 455 Colyton Street
PORTLAND — 733 N. W. Everett St.

STEEL STRAND ◆ TELEPHONE WIRE

Crapo GALVANIZED PRODUCTS

SPECIFIED BECAUSE OF PROVED PERFORMANCE

Crapo Galvanized Steel Strand has earned its enviable reputation for long, dependable, economical life by outstanding performances in actual service. That's why it so often is specified by leading utilities for the more important construction jobs. The heavy, uniform, pure zinc coating—applied by the *Crapo* Process—is notable for its adhesion and ductility; its ability to withstand bending and twisting; its lasting resistance to corrosion. Both the finished strand, and the wire from which it is made, conform in every detail to the most rigid specifications for tensile strength, elongation, size, galvanizing and ductility.

Crapo Galvanized Strand is readily available in all standard grades and sizes. Ask your Jobber, or write direct for technical details!

ALBERT GRUBER, Washington Water Power Co., Kamiah, Ida., was February winner of one of the three $10 prizes offered monthly by the National Electric Water Heating Council for the best letter on "How I Sell Electric Water Heaters."

●

G. S. SPANGLER, connected with Curtis Lighting, Inc., in Chicago since 1936 and previously connected with General Electric Co., has been named Curtis representative in Denver.

●

P. R. ROSEN of Grays Harbor Railway & Light Co. was appointed by Governor Martin of Washington as a member of the state commission at the Swedish Delaware Tercentenary.

●

NORMAN H. SALVESEN, Utah Power & Light Co. foreman-operator at Hyrum, Utah, has been awarded the National Safety Council's president's medal for his successful resuscitation of an injured motorist.

●

SHERMAN AND EUGENE NIELSON have assumed active management of Nielson's Furniture Co., Montpelier, Ida., and have taken over quarters formerly occupied by Skaggs Safeway.

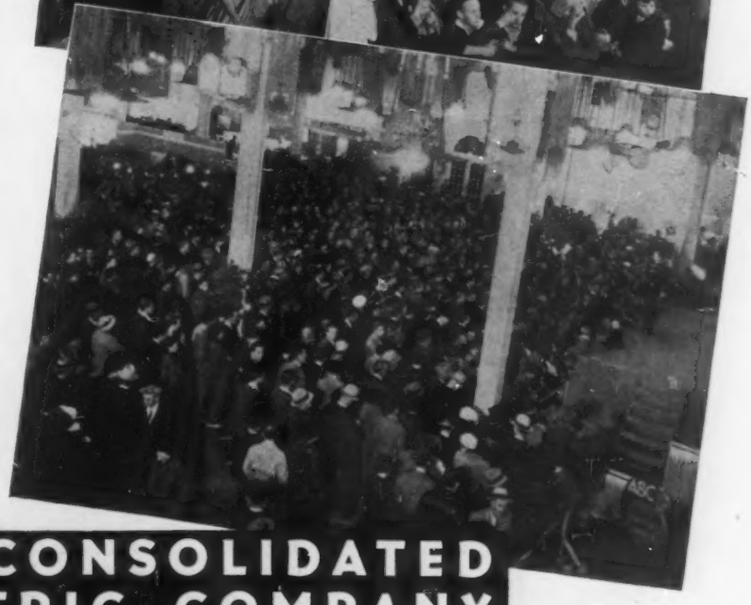
●

Deaths

M. V. WATSON, vice-president and general manager of the West Coast Power Co., California Public Service Co. and Western States Utilities Co., died April 25 in Portland. Born in Kansas, Mr. Watson was first associated with the electrical industry in 1898 in the W. T. Osborne shops in Kansas City. Later he was chief electrician for the U.S. Reduction & Refining Co. in Colorado. After a year as superintendent of hydro plants of the Guanajuato (Mex.) Power Co. he served in the engineering department of Central Colorado Power Co. In 1909 he became general manager and chief engineer of the Arizona Power Co. at Prescott. In 1926 he went to Portland as executive manager of the three subsidiary companies of the Peoples Light & Power Corp. He has been vice-president and general manager since March 1937.

LARS R. JORGENSEN, 62, well-known Western hydroelectric engineer and patentee of the constant angle arch dam, died in Berkeley, May 8. Mr. Jorgensen was born in Denmark and educated in Germany, where he studied both mechanical and electrical engineering. On coming to the United States he was employed by the General Electric Co. at Schenectady from 1901 to 1903. In the latter year he came to the Pacific

Seeing is selling!



That this is the age of showmanship in selling is here convincingly demonstrated. During the past six years 500,000 prospects have had first hand contact with electric appliances through **Spring Fairs, Electric Shows, Ironing Institutes and "Coming Out" Parties** conducted jointly by the San Diego Consolidated Gas and Electric Company and the Bureau of Radio and Electric Appliances (the latter a dealer-cooperative organization).

Acting on the theory that neither depression or recession has any influence on a FREE SHOW and that any activity is better than none as a sales stimulant during tardy business periods San Diego exhibitors have proven their point beyond a doubt.

That the shows have contributed greatly to an ever increasing sale of kilowatt-hours cannot be denied. We are sincerely grateful for the loyal cooperation of both dealer, distributor and manufacturer. Together we have built an institution devoted to mass selling and the accompanying photographs are submitted as convincing evidence of enthusiastic public acceptance.

SAN DIEGO CONSOLIDATED GAS & ELECTRIC COMPANY

THE BEST IN
FRICTION TAPE
SINCE 1888

Representatives

H. B. SQUIRES CO. Los Angeles Seattle
GEO. E. HONN CO. San Francisco

CLIFTON MFG. CO.
INC.
BOSTON, MASS.

Coast where he worked on the engineering staffs of several power companies. In 1907 he became a member of the consulting engineering firm of F. G. Baum & Co. Seven years later he formed his own firm, the Constant Angle Arch Dam Co. of San Francisco, which he headed until his death. He was widely known for his work on arch dams of the type he patented and was awarded the Norman gold medal by the ASCE in 1918. At one time he was chief engineer of the Feather River Power Co.

JOHN C. RESTON, president and managing director of Reston Electric Co., Vancouver, B. C., and former secretary of the Vancouver Electrical Assn., died in Vancouver in April. Coming to British Columbia in 1911, Mr. Reston joined Hinton Electric Co. In 1915 he was appointed superintendent of fire alarms for the Corporation of South Vancouver and in 1917 became superintendent of the marine electrical department of Coughlan & Sons. He started in business for himself in 1920. From 1920 to 1936 he served almost continuously as secretary of the electrical association.

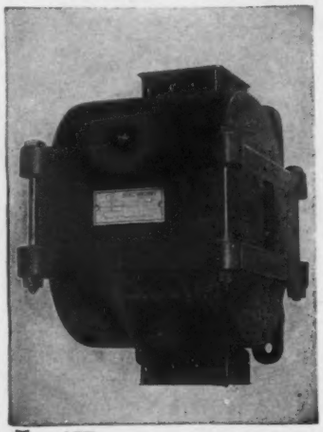
HENRY MELLMAN, 49, supply salesman with Westinghouse Electric Supply Co., San Francisco, died at Lodi, Calif., May 17. Prior to his connection with Westinghouse, Mr. Mellman had been a contractor connected with Spott Electric Co., Oakland; had later been in business for himself.

Speakers

At a meeting to prepare manufacturers', distributors' and Pacific Gas and Electric Co.'s salespeople for the spring refrigerator drive of the Electric Appliance Society of Northern California—H. M. Crawford, general commercial manager of P.G.&E.; Bert Reynolds, promotional manager, and Rodney Doerr of the commercial department. George Eberhard, Eliott Epstein and Harry Sax Jr. spoke at a meeting which launched the San Francisco unit's part of the drive.

Before the Sight Conservation Council of Northern California—Dr. Frederick E. Cordes, clinic professor of ophthalmology of the University of California Medical School: "Significant is the use of Vitamin A in treatment of persons whose eyesight is affected by too glaring or too high levels of illumination." Dr. Leland H. Brown, Stanford University: Fundamentals in Light for Seeing. H. F. Robinson, American Seating Co.: Sitting Posture and New Sight Conservation Desks. Dr. R. S. French, council president, and Clark Baker, secretary.

YOU SAVE



With JEFFRIES

AIR COOLED TRANSFORMERS

● With a Jeffries Air Cooled Transformer money can be saved. The Air Cooled construction lengthens the life of the transformer and lowers repair costs. Plant expansion and extension can be made economically for a Jeffries Transformer provides the voltage change at the point desired without the need of long and expensive conduit runs. Besides a complete line of standard transformers, special designs and voltage furnished to order. Type S. S. Transformer 1 to 5 K. V. A. illustrated.

JEFFRIES TRANSFORMER COMPANY
5706 LONG BEACH AVE., LOS ANGELES

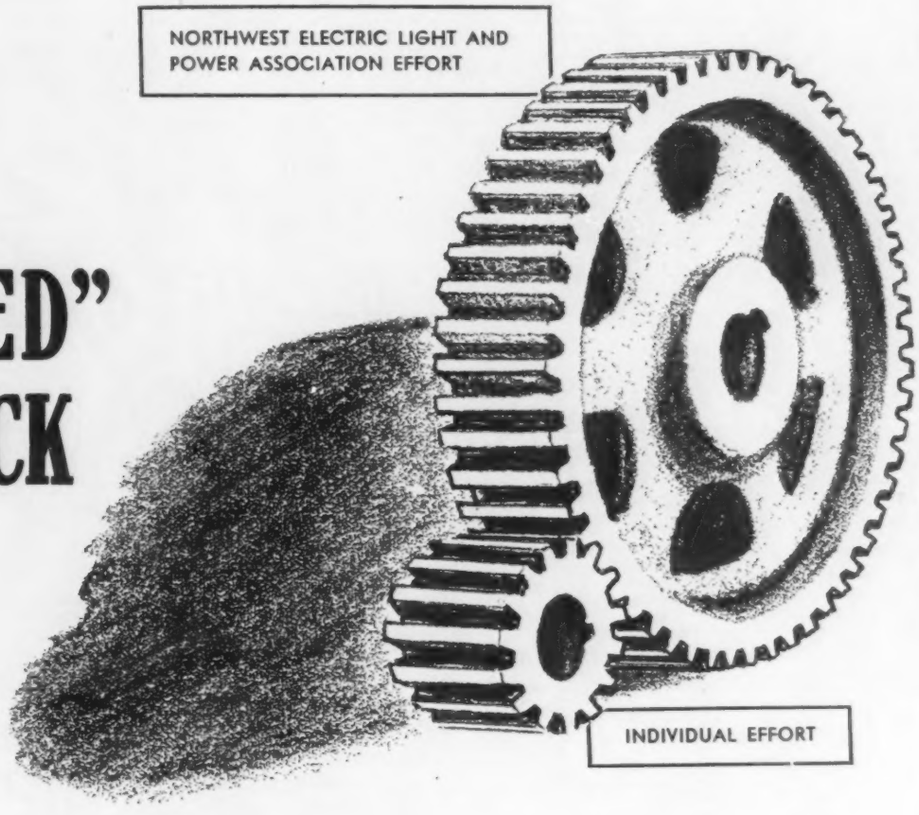
Less Work Next Year

If you have substantial holdings of securities, this booklet will interest you. It explains how our inexpensive Agency Service would be helpful to you, not only at income tax time, but throughout the year...by relieving you of all bothersome routine and time-wasting details.

You may have a copy, on request.

CROCKER FIRST NATIONAL BANK
OF SAN FRANCISCO
California's Oldest National Bank

"GEARED" TO LICK *the hardest tasks*



The brand of business courage that built the electrical industry in the Northwest knows no obstacles. Fed by this courage, individual cooperation put into gear with group cooperation will pull the industry over the greatest humps today.

This cooperative spirit can be best expressed through membership in the Northwest Electric Light and Power Association. Its efforts and aims, through united action, help safeguard the industry's future, its profits, its wages, and community development.

If you derive your bread and butter from the electrical industry of Washington, Oregon, Utah, Montana, Idaho, or British Columbia, express your own faith in the industry's future by becoming a member of this association. Then you can enjoy the satisfaction that comes from association with group cooperative effort which aims toward advancing the industry and every individual in it.

For your membership write to the secretary of the association at address below.

NORTHWEST ELECTRIC LIGHT and POWER ASSOCIATION

707 Spalding Building **Portland, Oregon**

Before the Illuminating Engineering Society, Southern California Section, Los Angeles—W. T. German and Foster K. Sampson: The Advanced Lighting Conference at Nela Park, Cleveland.

At the April meeting of the Electrical Maintenance Engineers Assn. of Southern California—Crawford McGinnis, Associated Wholesale Electric Co.: Iron and E.M.F.

At a meeting held by Western Agencies, Ltd., Vancouver, British Columbia distributor of Norge refrigerators, for managers and executives of 35 Vancouver and New Westminster refrigeration firms—W. C. Clark, Western Agencies' president; Earle Henderson, sales manager; Loren G. White, promotional manager; W. T. Burnham, Western sales manager, Norge Division Canadian Radio Corp.

K. L. Howe, Seattle: Electric Power in the Timber Industry—before members of the Vancouver, B. C., section, American Institute of Electrical Engineers.

At the annual meeting of the Seattle section, AIEE—L. E. Hill Jr., plant engineer, Weyerhaeuser Timber Co.; Mechanical Features of the Timber Co. Plant; and Gerald Alcom, technical director, Weyerhaeuser Timber Co.; Chemical Processing in the Manufacture of Pulp.

Vernon E. Vining, director of department store sales, Westinghouse Electric & Mfg. Co., will speak at the Radio & Appliance Trade Dinner at the Western Furniture Exchange July 27.

●

TRADE NOTES

GORDON E. WILKINS IRONERS, INC., Oakland and Los Angeles, is specializing in the distribution of Ironrite Ironers and kindred items in California. The company, under the direction of Gordon E. Wilkins, president; J. C. McGinley, vice-president, and Mary D. Wilkins, secretary, maintains warehouse stocks in Oakland, Los Angeles, Denver and Phoenix.

●

KOFORD'S FURNITURE STORE, Salt Lake City, has added the L & H line of ranges and the Crosley Shelvador refrigerators.

●

MACDONALD ELECTRIC, LTD., Victoria, B. C., celebrating its seventh anniversary, has augmented its office space, equipment and staff; expanded its appliance merchandising program to include the weekly budget payment plan; established special refrigerator displays.

●

NOAD-NICHOLAS, San Francisco, and F. S. Fletcher, Los Angeles, have been appointed by W. O. Helwig of the Helwig Co. as distributors of Helwig-Speer Carbon brushes. New and enlarged stocks will be carried.

●

TINGSTAD & HAMPTON, Everett, Wash., is a newly incorporated appliance store handling refrigerators, radios and all types of household electrical appliances.

●

STERLING REFLECTOR CO. is the new name of Reflector & Illuminating Co., 1435 W. Hubbard St., Chicago.

●

COAST DISTRIBUTORS, LTD., Vancouver, B. C., has opened a branch store, featuring radios and domestic electrical appliances, at Vernon, B. C.

●

WILLAMETTE REFRIGERATION CO., Portland, has been appointed distributor for Kelvinator commercial refrigeration and air conditioning.

●

ELECTRICAL TESTING LABORATORIES, New York City, has purchased and refitted a new and larger building at East End Ave. and 79th St., adjoining its present quarters.

INDEPENDENT PNEUMATIC TOOL CO., Chicago, has opened a new sales-service branch at 6200 E. Slauson Ave., Los Angeles. B. J. Herron is in charge.

●

STROWBRIDGE HARDWARE CO., Portland, has taken on the Zenith refrigerator line.

●

MODERN KITCHEN BUILDERS is a new kitchen planning service started in Portland by Helen Donaldson and L. O. Gallien.

●

Moved

KUHNHAUSEN'S, Portland, to new downtown location at 334 S.W. Morrison St.

LEE V. COX, Pacific representative for the Norge division of Borg-Warner Corp., from Los Angeles to the Leo J. Meyberg display space at the Western Furniture Exchange, San Francisco.

ROBINSON CO., Los Angeles electrical dealers, from 3992 S. Figueroa St. to 4527 Cimarron St.

HOLLAND ELECTRIC CO., Whittier, Calif., from 130 N. Greenleaf St. to 160 N. Bright St.

RICHMOND ELECTRIC CO., San Francisco, from 1370 40th Ave. to 1245 20th Ave.

STEWART WARNER SALES CO., from 1047 Seymour St., Vancouver, B. C., to new premises in the 1200 block, Seymour St.

●

NEW PRODUCTS

Free to you . . . Any of these instructive bulletins simply by addressing a post card to ELECTRICAL WEST and asking for the desired bulletin by number.

601:
"WHEN YOU CAN MEASURE;" exceptionally beautiful 32-page brochure telling how General Electric designs, constructs and tests instruments.

602:
BOILER METERS; analysis of 7,000 combustion tests made on all types and sizes of boilers; advantages of Bailey Meter Co. boilers.

603:
TYPE E SOCKET INSTRUMENTS; applications, economic advantages, construction details and selection of sockets described. Westinghouse.

604:
FIBRE CONDUIT for cable protection; characteristics, economy, types described. Fibre Conduit Co.

605:
"WE RAISED OUR POWER FACTOR;" case study showing how Electric Controller & Mfg. Co. raised its power factor and saved about $900 a year.

606:
WIRES, CABLES, cords and cable accessories; cataloged as to general construction, application and market. General Cable Corp.

607:
"RECONDITIONING FLOODED ELECTRIC EQUIPMENT;" 14-page treatise covering almost every type of equipment. General Electric No. GEA-2571B.

608:
HOISTS AND GATES; various types described and bountifully illustrated in actual use. S. Morgan Smith Co.

ELECTRICAL TESTING LABORATORIES

Electrical Photometrical, Chemical and Mechanical Tests. Inspection of Materials and Apparatus at Manufactory.

80th St. and East End Ave., New York

THE SAFE ANCHOR FOR R. E. A. CONSTRUCTION!

For long life and economy in annual maintenance cost, Everstick Anchors are first choice in rural electrification construction. Their safety and dependability have been proven on millions of miles of electric lines.

ANCHORS FOR EVERY PURPOSE

The complete line of Everstick Anchors offers three expanding types in a complete range of sizes and holding capacities. Also rigid type Cone Anchors in all sizes. Made of malleable iron with its properties of strength, elasticity and rust resistance. Write for new bulletin "Everstick For Rural Electrification."

The Everstick Anchor Co. ☆ **FAIRFIELD, IOWA**

Going Places by WORKING TOGETHER!

IT TAKES team work to make yardage in modern football. And it takes cooperation for industry to progress and profit in the face of today's numerous economic problems.

The common goal of the P.C.E.A. and its individual membership is to assure the prosperous functioning of the industry in the West. Again after this year's convention, hundreds of delegates went back to their work with renewed vigor and interest in their jobs.

Are you one of the 2908 members of the P.C.E.A.? If not, join today. You will profit by the expansion of your knowledge of the industry and by contributing toward the maintenance of its prosperity.

PACIFIC COAST ELECTRICAL ASSOCIATION, INC.

★

447 Sutter St., San Francisco

601 W. Fifth St., Los Angeles

713 T. W. Patterson Bldg., Fresno

609:
OIL AND INERTEEN drying and purifying outfits; types, their operation and applications described. Westinghouse.

610:
AIR CIRCULATION in home, store, factory, etc.; illustrated booklet telling how to sell. Cleveland Heater Co.

611:
SILICA GEL DEHYDRATOR; operation in relation to industrial and comfort uses described in booklet. Carrier Corp.

612:
SWITCHBOARDS; bulletin describing complete Allis-Chalmers line, applications and construction.

613:
DISTRIBUTION AND FARM LINE MATERIALS completely cataloged and illustrated; also charts on the stringing of conductors. Ohio Brass Co.

614:
AIR CONDITIONING; bulletin telling about York Ice Machinery Corp.'s packaged unit.

615:
WIRING SYSTEM with movable outlets; advantages, parts, installation described and illustrated. Bull Dog Electric Products Co.

616:
AUTOMATIC SERVICE RESTORERS, motor-operated, fully described in 4-page leaflet. Pacific Electric Mfg. Co.

617:
INSTRUMENT TRANSFORMERS, various types illustrated and described. Westinghouse.

618:
FLUORESCENCE; booklet describing commercial and industrial applications with new "NiCo" lamp. General Electric.

619:
ELECTRIC MOTORS described and illustrated in three leaflets. U. S. Electrical Motors, Inc.

620:
LUMINAIRES, two new models, illustrated and described. Pittsburgh Reflector Co.

621:
SINGLE STAGE TURBO-BLOWERS, overhung, pedestal, and double inlet types; illustrated pamphlet giving pertinent data. Allis-Chalmers.

622:
RELAYS, TIMERS and thermostats treated in technical catalogue. Struthers Dunn, Inc.

PRODUCT DATA

Fluorescent Lumiline Lamps

Westinghouse and General Electric have both announced fluorescent lumiline lamps which provide all the pastel tints of the rainbow. The lamps, tubular in shape and equipped at each end with two pins which fit into a special receptacle, are said to give more light per watt, color for color, than incandescent or luminous vapor lamps. In tinted lamps from 30 to 50 times as much light per watt is produced. One of the lamps produces the nearest approach to natural daylight ever achieved. Characteristics claimed for the lamps are high efficiency, coolness in operation, low surface brightness.

●

Table Fan

New fan set horizontally in the bottom of a round table has been introduced by Kisco Co. Fan, which faces upward, is said to circulate cool air in all corners of the room. All mechanical parts are enclosed.

●

Kitchen Ventilator

Claimed for the new kitchen ventilator announced by Universal Blower Co. is ability to ventilate against an outside, opposing wind of any intensity through use of a housed, automatic damper instead of the usual louver or door construction. All springs, levers and pull chains are thus eliminated.

●

Portable Air Filter

Portable electric fan and air filter unit for supplying fresh air to any room has been developed by Ilg Electric Ventilating Co. Unit, which can be used with any sliding sash window, has a maximum capacity of 250 cu. ft. of air per minute. Regulator provides for introduction of air in volume desired; revolvable grille permits deflection of air in any direction.

●

Rubber-Bladed Fan

Large 24-in. circulator fan with flexible rubber blades has been introduced by Samson-United Corp. Emphasized by company salesmen are the claim that the unit is 1,400 per cent quieter than most fans and the fact that wire guards are obviated by the rubber blades.

Glass Tape & Wire

Two companies, Anaconda Wire & Cable Co. and Corning Glass Works, have announced production of glass tapes. Anaconda is manufacturing Vitrotex magnet wire and coils. In appearance these resemble silk, but they have ability to withstand high temperatures for long periods of time. The insulation is mechanically strong and the wires can be wound into coils by following the same general methods used for other magnet wires. Space occupied by the wires is less than double cotton of the same gage. Corning's product is an electrical insulating tape intended for the insulation of coils for motors, generators, transformers and for cables and other electrical conductors. The tape impregnates readily with resins, gums and varnishes to form an insulation impervious to moisture and of high dielectric strength.

●

Burglar Alarm

Portable electric eye burglar alarm which can be bought and installed by the customer has been introduced by Teletouch Industries, Inc. Alarm inside unit starts ringing when intruder breaks path of beam and cannot be silenced except by owner.

●

Cleaners

Three floor models, all equipped with motor-driven, revolving brushes, and two hand models, one of which has motor-driven brush, mark Blackstone Mfg. Co.'s entrance in the vacuum cleaner field.

●

Small Range

Complete electric cooking is available in a compact range announced by Malleable Iron Range Co. Especially adaptable to small apartments, summer cottages, etc., the range has one 1,000-watt surface unit, one 550-watt surface unit and a roaster-baker with 1,000-watt unit. Range is of the plug-in type requiring only a low-cost two-wire connection.

●

Six Ranges

Crosley Radio Corp. has entered the electric range field with six models including all types from deluxe to kitchenette. Optional at additional cost is the Speedwell Cooker, a deep container, controlled the same as the oven, that may be installed in place of a top burner or built in the upper utility drawer. Available on certain models is the convertible oven equipped with one unit or two.

WHERE TO BUY IN THE WEST

Air Conditioning
Frigidaire Corp.
General Elec. Co.
Graybar Elec. Co., Inc.
Kelvinator Corp.
Norge Division, Borg-Warner Corp.

Ammeters and Voltmeters
Ferranti Elec., Inc.
General Elec. Co.
Roller-Smith Co.
Westinghouse Elec. & Mfg. Co.
Weston Elec. Instr. Corp.

Anchors, Guy
A. B. Chance Co.
Everstick Anchor Co.
Hubbard & Co.
James R. Kearney Corp.
W. N. Matthews Corp.

Anchor and Guy Rods
A. B. Chance Co.
General Elec. Co.
Hubbard & Co.
Maydwell & Hartzell, Inc.

Appliances, Household
Apex-Rotarex Mfg. Co.
Chicago Flexible Shaft Co.
Clements Mfg. Co.
Easy Washing Machine Corp.
Edison General Elec. Appliance Co., Inc.
Frigidaire Division
General Elec. Co.
General Elec. Supply Corp.
Graybar Elec. Co., Inc.
Kelvinator Division
Landers, Frary & Clark
Leonard Division
Malleable Iron Range Co.
National Enameling & Stamping Co.
Noblitt-Sparks Industries, Inc.
Norge Division
Standard Elec. Mfg. Corp.
The Silex Co.
Thermador Elec'l Mfg. Co.
Utility Electric Co.
Wesix Elec. Heater Co.
Westinghouse Elec. & Mfg. Co.

Boxes
General Cable Corp.
General Elec. Co.
Superior Switchboard & Devices Co.

Brackets, Wood
Locust Pin Co.

Breakers
Air Circuit Breakers
Electric Material Co.
General Elec. Co.
I-T-E Circuit Breaker Co.
Roller-Smith Co.
Sangamo Elec. Co.
Westinghouse Elec. & Mfg. Co.
Oil Circuit Breakers
Allis-Chalmers Mfg. Co.
Electric Material Co.
General Elec. Co.
Line Material Co.
Pacific Elec. Mfg. Corp.
Roller-Smith Co.
Westinghouse Elec. & Mfg. Co.

Bus Fittings
Burndy Eng'g Co.
General Elec. Co.

Buses
Aluminum Co. of America

Bushings
General Elec. Co.
Lapp Insulator Co., Inc.
Locke Insulator Corp.
Ohio Brass Company
Westinghouse Elec. & Mfg. Co.

Cable Accessories
General Cable Corp.
General Elec. Co.
James R. Kearney Corp.
John A. Roebling's Sons Co.

Cable, Armored
American Steel & Wire Co.
General Electric Co.
Hazard Ins. Wire Works
Okonite Company
Roebling's Sons Co., John A.
Triangle Conduit & Cable Co.
Wiremold Company

Cables
Aluminum Co. of America
American Steel & Wire Co.
Columbia Steel Co.
Copperweld Steel Co.
Crescent Ins. Wire & Cable Co.
Crucible Steel Co. of America
General Cable Corp.
General Elec. Co.
Graybar Elec. Co., Inc.
Hazard Ins. Wire Works
Indiana Steel & Wire Co.
Marwood Limited
Maydwell & Hartzell, Inc.
The Okonite Co.
Okonite-Callender Cable Co.
Providence Insulated Wire Co.
John A. Roebling's Sons Co.
Triangle Conduit & Cable Co., Inc.
United States Steel Corp.
Westinghouse Elec. & Mfg. Co.

Carbon Brushes
National Carbon Co., Inc.
Union Carbide & Carbon Corp.

Carbon Products
National Carbon Co., Inc.
Union Carbide & Carbon Corp.

Chimes
Square D Co.

Clamps, Ground
Copperweld Steel Co.
B. Hartman
Reliable Elec. Co.

Clocks, Program
Tork Clock Co., Inc.

Coffee Makers
The Silex Co.

Coil Winding
Jeffries Transformer Co.

Commutator Dressers
Ideal Commutator Dresser Co.

Compounds, Insulating
Clifton Mfg. Co.
John C. Dolph Co.
General Cable Corp.
General Elec. Co.
Irvington Varnish & Insulator Co.

Condensers, Electric
Allis-Chalmers Mfg. Co.
General Elec. Co.
Westinghouse Elec. & Mfg. Co.

Conduit
Aluminum Co. of America
General Elec. Co.
Triangle Conduit & Cable Co., Inc.
Youngstown Sheet & Tube Co.

Conduit, Flexible Metallic
General Elec. Co.
Triangle Conduit & Cable Co., Inc.
Wiremold Co.

Conduit, Underground
Fire Proof Wall Co.
Johns-Manville Corp.

Connectors
Burndy Eng'g Co.
Electric Power Equip. Corp.
G & W Elec. Specialty Co.
James R. Kearney Corp.
W. N. Matthews Corp.
Reliable Elec. Co.
L. W. Thompson

Controllers
Allis-Chalmers Mfg. Co.
General Elec. Co.
Square D Co.
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg. Co.

Cutouts
G & W Elec. Specialty Co.
General Elec. Co.
James R. Kearney Corp.
Line Material Co.
W. N. Matthews Corp.
Pacific Elec. Mfg. Corp.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.

Demand Control
General Elec. Co.
Wesix, Inc.

Distribution Specialties
G & W Elec. Specialty Co.
General Elec. Co.
Hubbard & Co.
James R. Kearney Corp.
Maydwell & Hartzell, Inc.
Ohio Brass Company
St. Louis Malleable Casting Co.
Superior Switchboard & Devices Co.
Waltham, De Witt & Krusi

Electrodes, Arc Welding
General Elec. Co.
John A. Roebling's Sons Co.

Enclosures, Meter and Instrument
Superior Switchboard & Devices Co.
Westinghouse Elec. & Mfg. Co.

Fans
General Elec. Co.
Wagner Elec. Corp.
Westinghouse Elec. & Mfg. Co.

Farm Electrification Equipment
General Elec. Co.

Fittings, Conduit
General Elec. Co.
B. Hartman
Killark Elec. Mfg. Co.

Fittings, Insulator
Brewer-Titchener Corp.
Ohio Brass Company

Fixtures, Lighting
Benjamin Elec. Mfg. Co.
Curtis Lighting, Inc.
General Elec. Co.
Pittsburgh Reflector Co.
Smoot-Holman Co.
Westinghouse Elec. & Mfg. Co.

Floodlighting
Curtis Lighting, Inc.
General Elec. Co.
Pittsburgh Reflector Co.
S & M Lamp Co., Inc.
Smoot-Holman Co.
Westinghouse Elec. & Mfg. Co.

Generators
Allis-Chalmers Mfg. Co.
General Elec. Co.
Westinghouse Elec. & Mfg. Co.

Graphite Products
National Carbon Co., Inc.
Union Carbide & Carbon Corp.

Ground Rods
Copperweld Steel Co.
Maydwell & Hartzell, Inc.

Heaters, Air
Edison Gen. Elec. Appliance Co.
Noblitt-Sparks Industries, Inc.
Thermador Elec'l Mfg. Co.
Wesix Elec. Heater Co.
Edw. L. Wiegand Co.

Heaters, Water
Edison Gen. Elec. Appliance Co.
The Electric Heater Co.
Standard Elec. Mfg. Corp.
Thermador Elec'l Mfg. Co.
Wesix Elec. Heater Co.
Westinghouse Elec. & Mfg. Co.

Heating Element—Repair Part
Montgomery Bros.
Edw. L. Wiegand Co.

Instruments, Measuring and Recording
See Ammeters, Voltmeters, Wattmeters.

Insulation
General Elec. Co.
Irvington Varnish & Insulator Co.
Johns-Manville Corp.

Insulators
Brewer-Titchener Corp.
Condon & Young, Inc.
Corning Glass Works
Graybar Elec. Co., Inc.
Hemingray Glass Co.
Geo. E. Honn Co.
Lapp Insulator Co., Inc.
Locke Insulator Corp.
Maydwell & Hartzell, Inc.
Ohio Brass Company
Owens-Illinois Glass Co.
Westinghouse Elec. & Mfg. Co.

Ironers
Easy Washing Machine Corp.
Edison Gen. Elec. Appliance Co.
General Elec. Co.
Norge Division, Borg-Warner Corp.
Westinghouse Elec. & Mfg. Co.

Lamp Guards
McGill Mfg Co.

Lamp Replacers
G. C. A. Mfg. Co.

Lamps, I. E. S.
General Elec. Co.

Lamps, Mazda
General Elec. Co.
Westinghouse Lamp Co.

Lamps, Sun
General Elec. Co.

Lighting Equipment
Benjamin Elec. Mfg. Co.
Curtis Lighting, Inc.
Keese Eng'g Corp.
Kim Mfg. Co.
Smoot-Holman Co.
H. B. Squires Co.
Sterling Reflector Co.
Westinghouse Elec. & Mfg. Co.
Wuelker Lighting Co.

Line Material
Hubbard and Company
Maydwell & Hartzell, Inc.
Ohio Brass Company

Meters
General Elec. Co.
Lincoln Meter Co.
L. A. Nott
Roller-Smith Co.
Sangamo Elec. Co.
Westinghouse Elec. & Mfg. Co.
Weston Elec'l Instrument Corp.
T. S. Wood

Motors
Allis-Chalmers Mfg. Co.
General Elec. Co.
Wagner Elec. Corp.
Westinghouse Elec. & Mfg. Co.

Motor Starters
Allis-Chalmers Mfg. Co.
General Elec. Co.
Square D Co.
Westinghouse Elec. & Mfg. Co.

Oil, Lubricating
Shell Oil Co.
The Texas Co.

Oil, Transformer & Switch
General Elec. Co.
Shell Oil Co.
The Texas Co.

Panel Boards
General Elec. Co.
Mongerson's Elec'l Mach. Works
Square D Co.
Superior Switchboard & Devices Co.
Westinghouse Elec. & Mfg. Co.

Photoelectric Cells
General Elec. Co.
Weston Elec'l Instrument Corp.

Pins, Wood
Locust Pin Co.

Pole Line Hardware
Brewer-Titchener Corp.
General Electric Supply Corp.
Graybar Electric Co., Inc.
Hubbard & Company
Joslyn Co. of California
Kortick Mfg. Co.
Maydwell & Hartzell, Inc.
Ohio Brass Company

Public Utilities
California Oregon Power Co.
Idaho Power Co.
The Montana Power Company
Mountain States Power Co.
Northwestern Electric Co.
Pacific Gas and Electric Co.
Pacific Power & Light Co.
Portland General Electric Co.
Puget Sound Power & Light Co.
San Diego Cons. Gas & Elec. Co.
San Joaquin Light & Power Corp.
Southern California Edison Co. Ltd.
Utah Power & Light Co.
Washington Water Power Co.

Pullers, Slack
A. B. Chance Co.

Pumps
Allis-Chalmers Mfg. Co.
Pelton Water Wheel Co.

Raceway and Fittings
Wiremold Company

Range Units
Edison Gen. Elec. Appliance Co.
Edwin L. Wiegand Co.

Ranges
Edison Gen. Elec. Appliance Co.
General Elec. Co.
General Elec. Supply Corp.
Kelvinator Corp.
Landers, Frary & Clark
F. S. Lang Mfg. Co.
Malleable Iron Range Co.
Norge Division, Borg-Warner Corp.
Standard Elec. Mfg. Corp.
Westinghouse Elec. & Mfg. Co.

G.C.A.
Lamp Replacers
Lamp base Removers
Cartridge Fuse Tongs
Switch Hooks

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Curtis Lighting, Inc.
Sterling Reflector Co.
Smoot-Holman Co.
Westinghouse Elec. & Mfg. Co.
Wuelker Lighting Co.

Refrigerators
Edison Gen. Elec. Appliance Co.
Frigidaire Corp.
General Elec. Co.
General Elec. Supply Corp.
Graybar Elec. Co., Inc.
Kelvinator Corp.
Leonard Refrigerator Co.
Norge Division, Borg-Warner Corp.
Westinghouse Elec. & Mfg. Co.

Relays
General Elec. Co.
Roller-Smith Co.
Square D Co.
Ward Leonard Elec. Co.

Rheostats & Resistors
General Elec. Co.
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg. Co.

Roasters
National Enameling & Stamping Co.
Westinghouse Elec. & Mfg. Co.

Rural Line Hardware
General Elec. Supply Corp.
Graybar Elec. Co., Inc.
Hubbard & Co.
Joslyn Co. of Calif.
Kortick Mfg. Co.
Maydwell & Hartzell, Inc.
Ohio Brass Company

Surface Raceway and Fittings
Pittsburgh Reflector Co.
Square D Company
Wiremold Company

Service Organizations
Brookmire Corp.
Crocker First National Bank
Elec'l Testing Labs.
McGraw-Hill Book Co.
Northwest Elec. Light & Power Association
Pacific Coast Elec'l Bureau
Pacific Coast Elec'l Ass'n
Rocky Mt. Electrical League

Strand, Guy
Copperweld Steel Co.
Maydwell & Hartzell, Inc.
Pacific Wire Rope Co.

Street Lighting Fixtures
General Elec. Co.
Graybar Elec. Co., Inc.
Hubbard & Co.
Line Material Co.
Westinghouse Elec. & Mfg. Co.

Switchboards
Allis-Chalmers Mfg. Co.
General Elec. Co.
Mongerson's Elec'l Mach. Works
Roller-Smith Co.
Square D Co.
Westinghouse Elec. & Mfg. Co.

Switches, Disconnect
Electric Power Equip. Corp.
General Elec. Co.
Kearney Corp., James R.
Line Material Co.
Pacific Elec. Mfg. Corp.
Schweitzer & Conrad, Inc.
L. W. Thompson
Westinghouse Elec. & Mfg. Co.

Look at the Business Side

Made in 6, 8 and 13-inch diameters. Described in Bulletin No. 60.

of the RHEOSTAT

While compactness and convenience of the control on the front are the last words in modern design, it's the back... the business side... that has won Ward Leonard Rheostats their reputation. They dissipate heat from the back as well as from the front. Accurately located steps of contact offer a wide range of accurate, smooth control. You must feel this rheostat to fully appreciate its mechanical perfection.

WARD LEONARD

48 SOUTH STREET, MOUNT VERNON, N. Y.

ELECTRIC CONTROL DEVICES SINCE 1892

Switches, Fuse
General Elec. Co.
Kearney Corp., James R.
Pacific Elec. Mfg. Corp.
Schweitzer & Conrad, Inc.

Switches, Heater
General Elec. Co.
Hart Mfg. Co.

Switches, High Tension
Bowie Switch Co.
James R. Kearney Corp.
Pacific Elec. Mfg. Co.
Schweitzer & Conrad, Inc.

Switches, Meter Test
General Elec. Co.
Square D Co.
Superior Switchboard & Devices Co.

Switches—Pressure and Temperature
Square D Co.

Switches, Remote Control
General Electric Co.
Hart Mfg. Co.
Roller-Smith Co.

Switches, Safety
Colt's Patent Fire Arms Mfg. Co.
General Elec. Co.
McGill Mfg. Co.
Meyers Safety Switch Co., Inc.
Mongerson's Elec'l Mach. Works
Square D Co.
Westinghouse Elec. & Mfg. Co.

Switches, Thermostat Controlled
Colt's Patent Fire Arms Mfg. Co.
General Elec. Co.
Hart Mfg. Co.
Thermador Elec'l Mfg. Co.

Switches, Time
R. W. Cramer & Co., Inc.
General Elec. Co.
Maydwell & Hartzell, Inc.
Sangamo Elec. Co.

Switchgear
Allis-Chalmers Mfg. Co.
General Electric Co.
I-T-E Circuit Breaker Co.
Roller-Smith Co.
Westinghouse Elec. & Mfg. Co.

Tapes—Friction and Rubber
Clifton Mfg. Co.
Geo. E. Honn Co.

Telephone & Telegraph Hardware & Specialties
General Elec. Supply Corp.
Graybar Elec. Co., Inc.
Hubbard & Co.
Maydwell & Hartzell, Inc.

Telephone Systems—Private
American Automatic Elec. Sales Co.

Terminals, Cable
General Cable Corp.
General Elec. Co.

Testing Devices
Superior Switchboard & Devices Co.

Tools
Mathias Klein & Sons
Maydwell & Hartzell, Inc.

Tools, Live Line
A. B. Chance Co.
James R. Kearney Corp.
Sangamo Elec. Co.
Wiremold Co.

Tools, Tree Trimming
Bartlett Mfg. Co.

Transformers
Allis-Chalmers Mfg. Co.
American Transformer Co.
Gardner Elec. Mfg. Co.
General Elec. Co.
Jeffries Transformer Co.
Line Material Co.
Moloney Electric Co.
Wagner Electric Corp.
Western Transformer Co.
Westinghouse Elec. & Mfg. Co.

Tubing, Elec'l Metallic
Aluminum Co. of America
Youngstown Sheet & Tube Co.

Turbines
Allis-Chalmers Mfg. Co.
Pelton Water Wheel Co.
S. Morgan Smith Co.

Valves
Ohio Brass Company
Pelton Water Wheel Co.
S. Morgan Smith Co.

Washers, Clothes
Easy Washing Machine Corp.
Edison Gen. Elec. Appliance Co.
General Elec. Co.
Landers, Frary & Clark
Norge Division, Borg-Warner Corp.
Westinghouse Elec. & Mfg. Co.

Wattmeters
General Elec. Co.
L. A. Nott
Roller-Smith Co.
Sangamo Elec. Co.
Westinghouse Elec. & Mfg. Co.
Weston Elec. Instrument Corp.

Water Wheels
Allis-Chalmers Mfg. Co.
Pelton Water Wheel Co.
S. Morgan Smith Co.

Wire
Aluminum Co. of America
American Steel & Wire Co.
Columbia Steel Co.
Copperweld Steel Co.
Crescent Ins. Wire & Cable Co.
Crucible Steel Co.
General Cable Corp.
General Electric Co.
Hazard Ins. Wire Works
Indiana Steel & Wire Co.
C. E. Ingalls
Keystone Steel & Wire Co.
Maydwell & Hartzell, Inc.
The Okonite Company
Pacific Wire Rope Co.
Providence Ins. Wire Co.
Rockbestos Products Corp.
John A. Roebling's Sons Co.
Triangle Conduit & Cable Co., Inc.
United States Steel Corp.
Westinghouse Elec. & Mfg. Co.

Wiring Supplies
Airey Co., F. J.
General Elec. Supply Corp.
Graybar Elec. Co., Inc.
Irvington Varnish & Insulator Co
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